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TESTING DYNAMO-ELECTRIC MACHINES.

THE letter which we published last week from Mr. Dunston, a gentleman who is, we believe, conversant with dynamo machines generally, induces us to venture upon a few remarks relative to this very important subject.

The pith of our correspondent's communication was the advocacy of a more uniform and comprehensive method of tabulating dynamo trials than that which has done duty in the past, and in this we cordially agree with him.

So far as the electrical measurements are concerned, there is no reason to doubt that there exist apparatus on which every dependence may be placed. When current strength, electromotive force, and resistance are actually measured, and when it is found that by calculating any one of these three functions from the combination of the remaining two, the calculated and measured results agree, we may be sure that the electrical data is free from error. Speed readings may also be taken very accurately, and many simple and reliable instruments can readily be obtained for such a purpose. It is, therefore, in the horse-power measurements that we may generally look for inaccuracies, and it is in this department that the want of an absolutely reliable dynamometer, or an approximately correct method of working has hitherto been so severely felt.

Some electricians are inclined to pin their faith to the steam-engine indicator as the only true mode of finding the horse-power consumed, but we do not think that this arrangement finds favour with the majority of engineers. Indeed, we are inclined to the opinion that when experimenting with machines which absorb but little horse-power and which require delicate tests, the steam engine should be left out of the question entirely; that is to say, the source of driving power for ordinary sized dynamo-electric machines not necessarily being derived from steam, need not be taken into consideration at all. Whilst commenting on this point, it may not be amiss to make an extract from a short article which appears in the last issue of the *Journal of the Franklin Institute*. It is entitled "Doctoring Indicator Cards," and the author, Mr. Robert Grimshaw, says:—

"One of the most common and literally transparent tricks is presenting tracings instead of the original card. Another is omitting the atmospheric and boiler pressure lines and drawing them in afterwards where best desired. This trick is also modified by drawing one of these in properly while the paper is on the barrel, and then shoving the paper down if the atmospheric line is drawn, or up if it is the boiler pressure line. Thickening all the lines so as to bring the diagram nearer the horizontal lines named is practised, as in 'taking the atmosphere' with steam connection not quite shut off. The latter is very often done unwittingly.

"Taking cards only from the end that has the highest initial pressure, or the freest exhaust, or the least clearance, is not unusual.

"About the best opportunity for deception is offered by the reducing rig. We will suppose that the valves, as made and set, cut off too late at the back end. The instrument is applied to the back end, and the cut-off point in the diagram set back from its proper place, if a reducing wheel is used, by leading the cord at an angle from the true parallel with the piston rod, which it should occupy at all positions of the cross-head. If a lever rig is used, the cord angle is made such as to give, for the first quarter or eighth of the outstroke, too little motion of the paper drum; and for the expansion period too much."

As a matter of fact, however, if our memory serves us aright, we believe that in the majority of officially tabulated results of dynamo tests, horse-power measurements have been made by means of transmission dynamometers of various types. The performance of all these apparatus appears to be within limits which are not very wide, and various objections are raised to their employment if accurate measurements are desired. The "belt" dynamometer, which has been used in this country by a scientific committee for comparing the efficiencies of certain dynamos, was tried and abandoned by an American Commission as being utterly unreliable, and the "Brackett" instrument substituted.

The Morin dynamometer, which has perhaps as good a reputation as any, seems approximately accurate at comparatively slow speeds only. It will be within the remembrance of our readers that this instrument was tried by the scientific experts who reported on M. Marcel Deprez's celebrated experiments on the electrical transmission of power. It was eventually cast aside, because it was found that to drive the dynamo-electric machine at its best speed, it was necessary to revolve the Morin dynamometer beyond its limit. The Prony brake was therefore enlisted in the service of the Commission, and very accurate results were thereby given to the scientific world.

With this apparatus, properly constructed and freely lubricated, errors, inherent to machines in which springs and centrifugal force play a part, are eliminated. We have only to deal with speed, which, as we have already said, can be ascertained to a nicety, length of lever, and dead weight. The employment of the Prony brake in conjunction with an indicating apparatus, seems to us, therefore, to present a very satisfactory and reliable method of arriving at the relative merits of dynamos of moderate capacities, the brake being probably limited to comparatively low horse-power. The Prony and Morin instruments have recently been employed in testing two different dynamo-electric machines in this country in the following manner.

The indications of the Morin apparatus were observed and recorded during the electrical tests. Afterwards a Prony brake was put on the dynamo, and the readings previously obtained on the dynamometer, when the power of the engine was converted into

electrical energy, were reproduced when the power was being opposed by the friction of the Prony brake, which could be exactly measured.

Our contemporary, *Engineering*, of May 2nd, in its commencement of an elaborate description of one series of these tests, very properly remarks, that "in this arrangement it matters little what kind of transmission dynamometer is employed, since, whatever disturbing influence the centrifugal force of the moving parts of the dynamometer has upon the indication during the electrical tests, the same will take place whenever the Prony brake absorbs the same power, at a given speed, as the electrical work did."

A well constructed brake is remarkably sensitive to any variation of weight on the end of the lever and will readily respond to a difference of less than 0·5 per cent. Our experience leads us to the belief that no difficulty is attached to their employment, and they may be, with very little practice, easily manipulated. With respect to that portion of Mr. Dunston's letter in which he points out that two efficiencies of conversion exist as well as two commercial efficiencies, we imagine that although it is now necessary to take matters as they stand, a more methodical and comprehensive system of tabulating the results of dynamo trials, which, we trust, will soon be forthcoming, will allow of reducing these efficiencies to one actual percentage of conversion and one of commercial utility.

Having said so much, we should heartily welcome the more extended opinions of Mr. Dunston on this interesting matter and also those of others of our readers, many of whom are well able, if willing, to do much towards the accomplishment of the wished-for end.

SUBMARINE CABLES.

(*Continued from page* 390.)

In gutta percha covered wires, when the insulating material is increased in size, it has been shown that the full effect of the increased thickness is not obtained, owing to the outer surface increasing at the same time.

There is also another quality possessed by resinous substances, and by gutta percha, worthy of consideration. It is the property of absorbing a charge in the mass of the substance, instead of its being confined entirely to the surface; the tendency of this will be to still further reduce the advantage of an increased thickness of insulating material. This in all probability is the reason why the actual decrease of induction observed through an increased thickness of resin, as described in reference to fig. 3, was not so great as theory would have indicated.

A reference to first principles will make this clearer.

All bodies insulate to a certain extent, and the only difference between a so-called conductor and insulator that would appear to exist, is a difference of degree, and if a charged body is brought into the neighbourhood of an insulated conductor, induction will take place through it in the same way as through a dielectric, but owing to the particles of conducting substances possessing the property of readily communicating their forces one to another, the inductive force developed at the further extremity will, within certain limits, be scarcely affected by the length of the conductor through which induction is taking place.

The absorption of a charge within the substance of the dielectric is an approach to this condition, but its practical moment when gutta percha is the insulating substance has to be determined by experiment.

Lessening the induction by reducing the resistance has next to be considered.

The first thing obviously will be to obtain a metal of the highest specific conducting power, for could the sectional area be diminished without increasing the resistance, the induction would be reduced proportionately to decrease in the surface. The next will be increase the sectional area of the conductor, and although this involves increased surface, yet there will be a gain; for when the diameter of a wire is enlarged, the surface over which the amount of induction extends does not increase in the same ratio as the sectional area which determines the resistance opposed by a conductor. To make this clearer, let four cables ranged side by side be employed as one conductor.

Such an arrangement will possess four times the sectional area, and oppose only one-fourth the resistance; in other words, the same tension of current will force through four times the quantity of electricity that would be generated through the single cable when used alone. Signals would not, however, be transmitted more rapidly through the four cables than through the one, for although the conducting power has been increased four times, the surface has been quadrupled also, which will exactly counterbalance the lessened resistance; but merge the four into one, the external inductive surface will then be halved, whilst the sectional area will remain the same as before, and there will be only half the induction manifested.

It therefore follows when a wire is enlarged, that as the sectional area increases as the square, whilst the surface increases only in regular proportionals, the relative balance of forces in favour of rapidity of conduction will, in a submarine conductor of a given size, be twice the amount of that in a wire of half the diameter.

I would now attempt an explanation of how it happened that an actual retardation was observed in some of the experiments with the Atlantic cable when a conductor of enlarged sectional area was employed; and on this head I would again quote from my remarks on a former occasion:—

"In the experiments to ascertain whether any advantage would result from the use of an increased sectional area of metallic conductor, recourse was had to joining the cables side by side, the increased inductive surface which such an arrangement involved having possibly been overlooked. This will account not only for an increased speed not having been obtained, but for an actual retardation having been noticed. Electro-magnetic induction coils do not create electricity, they simply offer a ready means of converting electricity of low tension and considerable dynamic quantity into electricity of very high tension and small dynamic quantity. The quantity evolved by them is always smaller in proportion as the intensity is greater. Both cannot readily be obtained together, and if a very high intensity is required, the quantity must be sacrificed, unless the size of the apparatus is immensely increased. This difficulty has evidently been appreciated, as the induction coils used by the Atlantic Telegraph Company are of large size and great length, so as to obtain high tension with an appreciable dynamic quantity. Nevertheless, there is little doubt but that the quantity evolved even by these machines, when compared with that generated from voltaic batteries, is small. This being the case, on giving the current a larger number of channels to rush into, there is not enough electricity to fill the wires, consequently the tension of the current will be very much lowered. The effect of this will be that a longer time will elapse before the tension of the wire will be raised sufficiently high at the further extremity to render itself apparent on the instrument. To obtain, under such conditions, the same speed with four cables as would be obtained with one alone, it would be necessary to employ four of these induction coils, ranged side by side, and worked with four times the battery surface, so as to generate four times the dynamic quantity of electricity. When qualified with these conditions, under which, no doubt, the experiments were tried, the reasoning contained in the Atlantic Telegraph Company's pamphlet, given in an earlier portion of this paper, is correct. It is precisely a case of having four Leyden arrangements to charge instead of one. A telegraph cable is, in fact, a Leyden arrangement, which has to be charged to a certain degree of saturation before signals are obtained. The degree to which it has to be charged, statically, depends upon the extent of induc-

tive surface compared to the conductibility of the metallic core. In a circuit where the conductibility of the metallic core is very great, compared with the inductive surface of the insulating material, no high degree of statical charge can take place, and signals will pass quickly. The opposite effect will be noticed in a circuit where the inductive surface is very large compared with the conductibility of the metallic core. The wire will then have to be statically charged very highly, before a perceptible current will flow from the further extremity, and signals will be obtained proportionately more slowly."

The reason why signals are found to pass when magneto-electric induced currents are employed in place of voltaic ones arises, I believe, not from any specific difference between them, but simply from the tension of the induced currents being very much greater than any voltaic ones which have been employed.

On this head I will say nothing further here, but would refer those who may take an interest in it to my paper of a former occasion, where I have fully entered into this subject, and also attempted an explanation of how it has happened that in the experiments with voltaic currents, of varying intensities, no difference of speed has as yet been observed.

The amount of retardation which will be experienced in submarine circuits possessing conductors of varying resistance, and insulated with different thicknesses of insulating material, it appears to me can, comparatively speaking, be readily determined by actual experiment.

I have for a long time been engaged in designing an apparatus for this purpose, and at the time I arranged to give this paper, I fully expected to have had the apparatus completed in time to have been able to have laid it before you; and, though I regret not being able to do this, yet I feel I have sufficiently advanced to warrant my explaining the principles of its construction.

The principles upon which it is based are: that a body which offers the same resistance as another, without reference to its substance or length, may, as far as conducting power is concerned, be considered electrically the same. If we make use of a substance or metal of any inferior specific conducting capacity to that of the metal employed in submarine circuits, and also of greatly diminished sectional area, the same resistance as that offered by the very longest circuits can be obtained in a very small compass; and such an arrangement will, as far as simple conducting power is concerned, fairly represent a long submarine circuit.

The induction which manifests itself in submarine circuits can also be obtained if the conditions for its development are as favourable as they are in submarine conductors.

The apparatus consists, 1st, of a series of resistances, the values of which are known.

2nd. Of a series of induction plates, the values of which, when compared with a given surface of a gutta percha coated wire are also known.

3rd. A mechanical arrangement to accurately measure minute periods of time.

By a combination of the resistances and the induction plates, a conductor, which will fairly represent a submarine circuit, will be obtained.

The resistance can be diminished or increased, and the inductive surface can be doubled or halved at pleasure, and thus circuits with conductors of varying lengths and sectional area, and different thicknesses of insulating material be imitated, and the law which governs the retardation in the transmission of telegraphic signals determined by direct experiment.

It may be argued that as the inductive surface in a telegraphic circuit is uniformly spread throughout, a series of induction plates will not present the same conditions, but it is evident that they may be divided throughout also, and although they will not then precisely represent what is actually the case, the result will approximate very closely to those obtained from a submarine conductor.

Perhaps it would have been prudent not to have called attention to an apparatus before its completion. I have done so, however, because I have felt it was due from me to endeavour, at least, to point out how some of the important problems involved in submarine telegraphic communications between distant stations may be resolved.

The chief deductions from what has been brought forward in this paper are:—

1st. That the metallic core of a submarine cable should be composed of a conductor of the highest specific conducting capacity.

2nd. That a decrease in the retardation which is caused by the induction that takes place in submarine circuits, can only be obtained by increasing the thickness of the insulating material, or by using a wire of larger diameter, but that it will be better to do this by enlarging the sectional area of the conductor as much as is practicable.

In designing a cable there are many considerations besides those of its simple electrical qualifications which have to be entertained. The object to be obtained is the best result with the most economical investment of money. Are the proportions which were adopted in the Atlantic cable the best to ensure this?

The weight of the conductor in this cable is about 93 lbs. to the mile, the value of which, speaking roughly, would, I suppose, be about as many shillings. When served with gutta percha its value was raised to £40 per mile. The iron sheathing and getting the cable on board brought its value up to £100 per mile. The expenditure, however, did not cease here; there was the hire of ships, salaries of staff, &c., &c. In this cable, therefore, only four per cent. at the outside was invested in the conductor upon which the transmission of the messages depended.

If the views which I have brought forward are correct, a conductor of double the diameter would only produce half the amount of retarding force of one of half the size. Such a conductor, at the very outside, would not cost more than £19 per mile, and the increased expenditure, in serving such a conductor with gutta percha, and giving it an iron sheathing, would not, comparatively speaking, be very large; the expenses of the staff and the hire of ships would be about the same in both cases; the latter would be, perhaps, increased slightly, but not to any material amount.

There are a great many other points which should be entertained in such a paper as this, but the paper has already run out to such a length that I will not trespass any further on your patience; and in conclusion I would only add, that if the ventilation of the subject, through the medium of this communication, should tend in any way to the progress of electric telegraphy, the object of its author will have been obtained.*

DISCUSSION.

The CHAIRMAN, in inviting the electricians present to take part in the discussion, would call their attention to the generally-scientific character of the paper, although there was a passage towards the close of it which opened up a practical question of great importance. Even if this had not been so, he thought in a society like this, where they dealt generally with the practical application of scientific principles, he would have been justified in inviting gentlemen to enter more particularly into the practical application of the theory which had been so ably brought before them. He would call their attention especially to one view which had been expressed very clearly with regard to the difference which existed between the Leyden jar

* See excerpt minutes of Proceedings of the Institution of Civil Engineers, Vol. xvi., Session 1856–57.

See "The Atlantic Telegraph. A History of Preliminary Experimental Proceedings, &c., published by order of the Directors of the Company," pages 20, 23, 25, 26, and 40.

See also the *Engineer* of December and January, 1858–59. "A discussion on the Induction in Submarine Circuits," by X. Y. Z., G. Blair, M.A., Telegraphic Engineer, and J. Tatlock.

and a long line of insulated wire with a distant termination connected with the earth. Mr. Varley had put before them what insulation practically was in such a case. It was not the separation of a body in an electrical state entirely from all surrounding substances, but the amount of resistance offered by the long wire before it terminated in the earth. This distinction had been brought before them in a very lucid manner, and he thought they were much indebted to Mr. Varley for having done so. He hoped gentlemen present would give their ideas as to the proportion of metallic conductor that should be used in long lengths of submarine cables, such as that between this country and America; also as to the mode in which the conducting medium should be constructed—whether of a single or a compound wire. This, however, was not the whole question; they had to consider not only the thickness of the wire and insulator, but also whether the insulating substance—gutta percha—was the best that could be adopted for the purpose, and whether before the next great experiment was tried with an Atlantic cable, they could not obtain further light with respect to the insulating medium that was best adapted to a length of cable of that description, both as to cheapness and the power of resisting the pressure of the water, although he thought cheapness in that part of the conductor was a matter of minor importance. It appeared that the conductor itself was only 4 per cent. of the whole cost of the last great experiment to America. The additional cost of the conducting medium, even to the extent of 8 or 10 per cent. was not to be considered for a moment, but the point was, whether by increasing the dimensions of the conducting medium, they did not at the same time increase the amount of induction. He should be glad to hear the views of Mr. Walker on this subject, as that gentleman's experience would be most valuable.

Mr. C. V. WALKER had attended to listen and to learn, rather than obtrude his own views upon the meeting, but, being called upon, he would offer a few observations. The difference which Mr. Varley remarked between the Leyden jar and a submarine cable, was that which was generally recognised; it was simply a difference of degree as to the relative states of the inner and outer coating. The cable did practically possess all the distinctive character of the Leyden jar, notwithstanding that the inner and outer coatings were connected, as the experiments made with the Atlantic cable illustrated. The experiments worked out in the early part of the paper to determine the law of induction, would be found very clearly laid down by Sir William Snow Harris in the little book published by Weale. He had shown that the law of induction was inversely as the distance, and directly as the surface. The next clause of the paper referred to "intensity." This term had led to much confusion; moreover he thought in the present state of electrical science the conditions regarding conduction were far more completely expressed by the formula of Professor Ohm, than by Mr. Varley's diagrams. Another question in connection with submarine cables was the size of the conducting wires. This was a very important one, and he was quite sure they would think he was possessed of very little modesty if he ventured to give judgment upon a matter which, in his opinion, was so entirely a question of experiment that he only wondered the great cable was laid down before this important point had been satisfactorily investigated, so as to put the matter beyond the possibility of question, whether that conducting strand of seven wires was too large or too small. An opportunity occurred to him to try some experiments with seven or eight distinct miles of insulated wires of different sizes and different thicknesses of gutta percha insulation. The wires were in lengths of about one mile each, and the results of those experiments were decidedly in favour of a small wire as the conducting medium. There were many points in connection with small wires worthy of consideration, one of which was cheapness, because, although the per centage of saving upon a mile of wire was small, yet the saving would be very great in a cable to extend across the Atlantic. The smaller the wire was the greater the insulating power obtained from the same amount of gutta percha. The alleged disadvantage of the smaller wire was, that there was a greater resistance in the circuit; but, in the pamphlet published by the Atlantic Telegraph Company, the experiments made by Mr. Reid were described, from which it appeared that he sent a signal through 1,000 miles of cable with a battery of two plates only, excited by his tongue, so that the resistance to be overcome by that small battery could not have been great. Another point was the return wire, and upon that he considered the whole question of the Atlantic cable turned. What helped them on the one hand hindered them on the other. The effects of the magnetic disturbances of the earth would be obviated by a return wire. If two lines of cable were laid down and the current passed to Newfoundland by one wire and returned by the other this inconvenience would be got rid of, but they would have the other inconveniences which Mr. Varley had laid before them. If the two wires formed portions of the same cable they would cause a greater amount of retardation, because one wire would polarise the other. But if two wires were used in the same cable in a somewhat different fashion, namely, if one was laid as the centre wire, and the other carried spirally round it, and the current divided between the two wires, the polarisation would be very much reduced, if not entirely annihilated. Those two wires, however, would act externally upon the outer coating, which would render the advantage nugatory. In his opinion the next Atlantic cable would not be coated with an iron jacket, as the former one had been; but a coating of hemp and other non-conducting materials would be employed. It might be interesting to the meeting to know the time it actually took to send signals through the Atlantic cable. By Whitehouse's induction coil it took $1\frac{3}{4}$ seconds, whilst the battery current was 6 seconds in its passage through, at least as far as he recollected.

Professor TYNDALL said that the paper displayed a considerable amount of research, and an extensive acquaintance with the ordinarily accepted laws of electricity, as well as with the phenomena of retardation and induction. He would express the feeling that beset him, as he heard the paper read; and he spoke with all frankness and all respect to Mr. Varley and those, who like him, were engaged in these researches, when he said that knowledge such as had been displayed in this paper, ought to be somewhat like the manure that was applied to agricultural purposes: it ought to be put underground, and new fruits ought to sprout from it. He had been looking intently for the results of this knowledge which had been brought before them; some of it was interesting, but, for the most part, it did not deal with facts, but rather with conjecture, more or less ingenious. The whole subject involved a complicated problem. There was not a shadow of doubt that each element of it could, by proper experiment, be separated from the rest, and its due influence described with certainty; and this was what ought to be done, instead of speculating upon the laws of electricity. He thought those speculations ought to be the private property of the man who worked the subject; they ought to guide him in his searches after facts; and if he produced the facts, he could then show the connection there was between the facts and the first principles of the science. He would refer more particularly to what he should himself like to see done. He had heard remarks about thickening the wire and the surrounding insulation. He would ask had any particular experiments been made to ascertain the law of, or the benefit to be derived from, thickening the wire? Had experiments been made to determine the law by which retardation was diminished, when the thickness of the gutta percha coating was increased? They could take the absolute wires that were to be used, and cover them with gutta percha and India-rubber, and compare them, and they could tell with certainty which was the best insulator. They could tell the influence of the thickness of the wire, and the thickness of the

insulator; and he thought their knowledge of the principles of electricity ought to be the guiding light to carry their minds to the determination of these cardinal points.

(To be continued.)

REYNIER'S ZINC ACCUMULATOR.*

THIS new model is constructed upon the lead-zinc system, and its receptacle is preferably formed of two wooden boxes fitted one into the other, with a water-tight and insulating partition of bituminous material.

In this form of receptacle the cover is dispensed with; the rectangular cross-pieces which support and separate the plates, rest directly upon the edges of the box; they form together a sufficient covering.

The electrodes are seven in number, four positive, and three negative. The drawing, which shows the action of the accumulator, obviates the necessity for any further description. I will confine myself to giving the principal numerical data of the apparatus.

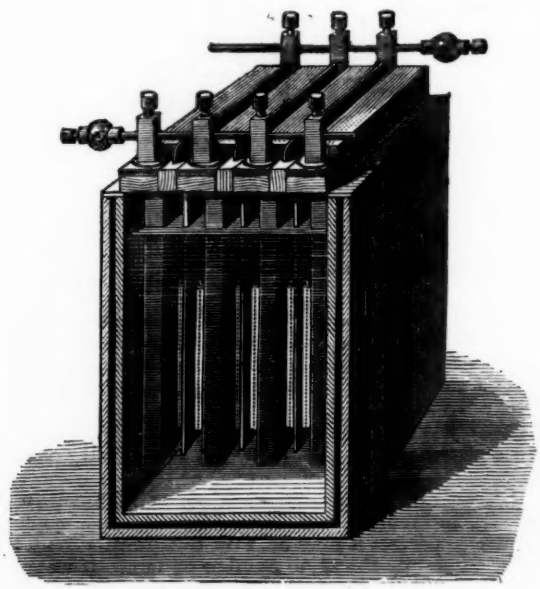
Physical Data.

E	Electromotive force	2·37 volts.
R	Mean resistance	0·02 ohm.
I	Mean intensity of the discharged current	25 ampères.
i	„ „ „ charge „	5 to 10 „
Q	Capacity of accumulation	550,000 coulombs.
$\frac{EI}{g}$	Normal work per second	5·7 kilogms.
$\frac{QE}{g}$	Work stored	126,500 „

Data of Construction.

Surface developed by the 4 positive electrodes ...	200 d. g.
External surface of the 4 „ „	20 d. g.
External surface of the 3 negative „	13 d. g.
Weight of the 4 positive electrodes	8·200 kilo.
„ „ 3 negative „	1·400 kilo.
„ „ liquid	4·400 kilo.
„ „ of the receptacle and accessories ...	3·160 kilo.
Total weight	17·160 kilo.

According to a previous trial a zinc accumulator should store 15,600 kilogrammetres per kilogramme;



the capacity of this is only half this figure. The difference results from the fact that I have purposely increased the weight of the electrodes, in order to increase their durability and strengthen the receptacle. We may take this into account in comparing the actual weights of the various organs with the calculated theoretical weights for a power of 130,000 kilogrammetres:

	Weight: Calculated kilo.	Actual kilo.
Lead	2·500	8·000
Negative electrodes	0·550	1·390
Oxygen	0·180	0·180
Acidulated water	4·140	4·400
Receptacle and connections ...	1·105	3·160
Total	8·475	17·130

It would be easy to reduce the accumulator to its theoretical weight, but its solidity and its durability would be diminished. In the actual state of the question I prefer to exaggerate the solidity and reduce the cost, in order to bring the accumulators into general use, and to obtain for them the confidence of electricians which the consequences of theory have put on the defensive.

Notwithstanding its increased weight, this accumulator is lighter than any made hitherto on the continent. (It is prudent to make some reservations relative to certain models of Faure accumulator, constructed in England, to which they attribute a very great but not unlikely, capacity.) In fact,

	Kilogrammetres.
1 kilogramme of Planté accumulator, small model, made by the inventor, stores	1,500
1 kilogramme of Faure accumulator, the old model of 8 kilo. with slate partition, stores	3,000
1 kilogramme of Faure accumulator, the 30 kilo. model, with cellules, stores .	4,400
1 kilogramme of zinc accumulator, the actual model of 17 kilo., stores ...	7,600

THE ELECTRIC LIGHT FOR FISHING OPERATIONS.

WE gave in the ELECTRICAL REVIEW for May 3rd, a short account of a trial run of the steamship *Tilly* on the Clyde, to which Messrs. Paterson & Cooper had fitted some electric light machinery, for the purpose of assisting in fishing operations, the destination of the vessel being the Batavian fisheries.

The lamp has similar mechanism to that made by the firm for workshop and other uses, but altered so as to suit so large a current as is necessary for a light of 15,000 C.P. The adjustment is effected by means of a key and plug-hole. A flint glass cylinder, protected by a wire guard, surrounds the whole. The bottom is easily detached to allow of trimming the carbons.

The machine is one of Paterson and Cooper's No. 4 series-wound "Phœnix" dynamos. These machines bear an outward resemblance to the Lumley, and one or two other forms in the market, the main distinction being the discarding of all interior projecting pieces in the armature. In some machines these projecting pieces exist for the purpose of dispersing the heat by conduction; in others, for the sake of air spaces to keep the armature cool. The need for this is obviated in the "Phœnix" machine, chiefly by more careful attention to the distribution of the magnetic field. These machines are said to run quite free from sparking. The one here illustrated is run direct from the crank shaft of one of Messrs. J. & H. Gwynne's 5½ in. × 4½ in. cylinder "Invincible" high speed engines, fitted with "Pickering" governor. The speed is 650 revs. The whole is mounted on one bed-plate. The space occupied by the two machines is 3 ft. 9 in. × 3 ft. 9 in. × 3 ft. 10 in. high; steam pressure, 56 lbs. to the square inch.

This arrangement, with the dynamo compound

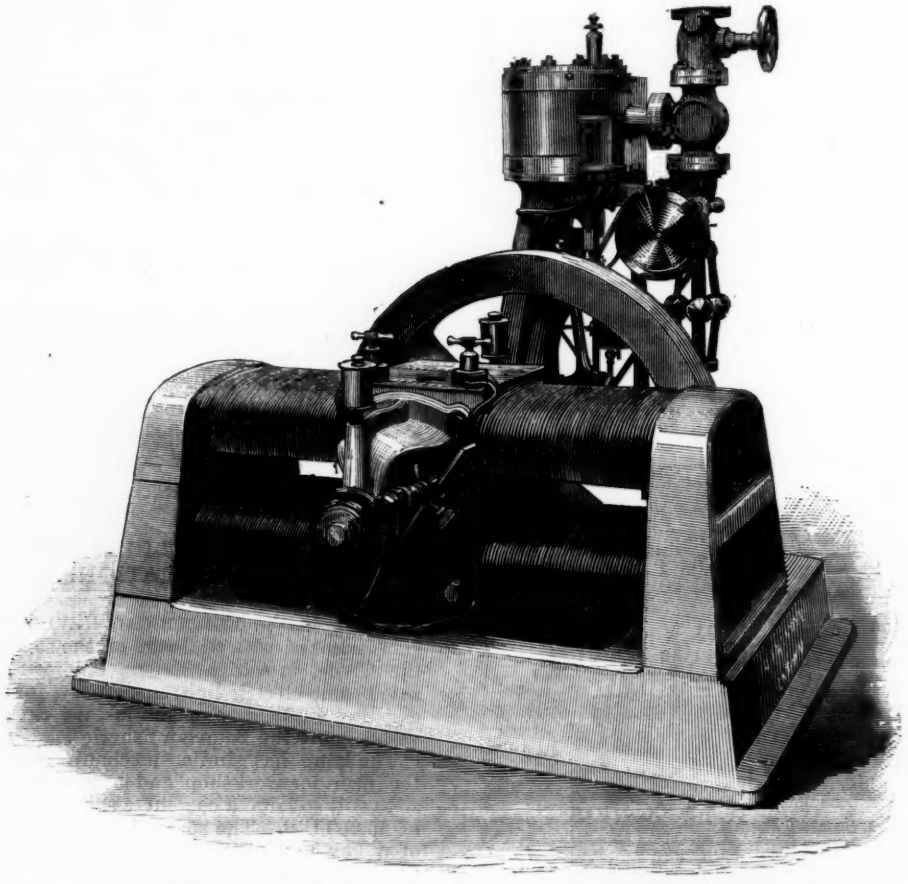
* M. Reynier in *L'Electrician*.

shunt-wound, is admirably adapted for incandescent lighting on board ship.

The leads from the dynamo to the lamp are very flexible, of specially stranded copper wires incased in India rubber tubes; they pass round a wooden drum which takes up the slack. The lowering gear consists of a winch with an iron drum for winding up the chain and lamp. The lamp may be lowered to a depth of 10 fathoms, and gives a powerful and brilliant effect at night.

The idea of using the electric light for fishing purposes is possibly capable of great development before long, it being well known that a very powerful light has a strangely fascinating effect on the finny tribes, which flock in great numbers towards the light centre, and can then be easily surrounded with a net.

The installation was made for Messrs. Hanna, Donald and Wilson, of Paisley, the builders of the vessel, under the advice and direction of Mr. John Hayes, C.E., who co-operated with the contractors in a very cordial way to make it a success. Great credit is also due to Mr. W. B. Esson, Messrs. Paterson & Cooper's electrician, for carrying out the electrical details.



COMBINED "PHŒNIX" DYNAMO AND "INVINCIBLE" HIGH-SPEED ENGINE.

THE EFFICIENCY OF SECONDARY GENERATORS.

THE report of Dr. Hopkinson upon the experiments relative to the efficiency of the induction coils of Messrs. Gaulard and Gibbs, has called forth from the scientific press numerous and justifiable criticisms.

Unfortunately the method employed for measuring this efficiency gave no certainty of accuracy. The objections made to the method of Dr. Hopkinson on the one hand, and the absence of any satisfactory method on the other, induced me, says M. Deprez, in *La Lumière Electrique*, to seek for a practical and indisputable means of measuring the industrial return of any system of transformers whatever. This method is as follows:

Let us suppose, for instance, that an alternating current machine supplies, without the intervention of any transformer, a hundred identical incandescence lamps, grouped so that each of them receive a current capable of making it produce the maximum brilliancy. This current will be, moreover, the same for all the lamps, since they are identical. Let us measure the speed of the machine, and note the indications of an electro-dynamometer placed, first between two consecutive lamps connected in series, and then in the general conductor. The first indication of the electro-dynamometer will make known the current required by a single lamp, or, to speak more accurately, will be a function of this current, and of the number of alternations which succeed each other in the unit of time. The second indication will be equally a function of the total current which traverses the machine. It is not necessary to know the exact signification of the indications of the electro-dynamometer, as we shall presently see.

Let us now place any transformer whatever in the circuit, and maintain the same speed of the machine. However perfect it may be, this transformer evidently will not supply the same number of lamps if we maintain the current which traverses them at the same value as before, and if we do not modify the speed and consequently the number of alternations of the current. The number of lamps will therefore be less, and we shall determine this by grouping them partly in series and partly in derivation, so as to satisfy the two conditions:

1st. Not to alter the current which traverses them individually, and consequently to make them give the same quantity of light as in the first experiment.

2nd. Not to alter the total current which traverses the machine.

We may satisfy both these conditions tolerably easily, and we can prove that they are fulfilled by means of the electro-dynamometer, which, placed successively between the lamps and in the general circuit, should give the same indications as when the transformer is not in use.

This done, the mechanical work absorbed in the unit of time by the generator, will evidently be the same in the two experiments, for to the same indication of the electro-dynamometer evidently corresponds the same mechanical effort developed between the fixed and movable parts of the generator, the speed of which has remained unaltered. The useful effect represented by the number of lamps lighted will, on the contrary, have become less, and the value of the true practical return is evidently the relation of the new number of lamps to the old, that is to say to 100, according to our proposition.

This method is, I repeat, free from any objection. It may be easily applied everywhere; the lamps may besides be replaced by inert resistances.

It is quite as accurate, and is much more easily applied than the calorimetric method, the only one which has hitherto been considered as incontestable, but which is never employed because of the difficulties of all kinds encountered in using calorimeters.

DIRECT DETERMINATION OF THE CAUSE OF THE DEFICIENCY IN DYNAMO-ELECTRIC MACHINES.

By M. G. CABANELLAS.

THE real existence of a deficiency of power in dynamo-electric machines is at present no longer contested, but there still exist among electricians absolute differences of opinion when it is requisite to determine the cause of this parasitic work and to localise its seat. Dr. Frolich ascribes it to the so-called currents of Foucault, induced during the movement of the machine by the inducing magnetisim in the iron of the armature of the Alteneck drum, or of the Gramme ring. I think, that in good machines of both types the deficiency is due to a cause of the order of electric resistance, seated in the induced wire.

We see that in the present condition of things it would be desirable that Dr. Frolich's explanation should be correct, since, other things being equal, it would permit us to hope on this side an increase of the yield of the machines when this imperfection shall have been got over.

In any case it is interesting and useful to have a decision on this subject.

The direct mechanical method which I have the honour of presenting to the Academy consists in combining an experimental arrangement, such that according as one or other of the effects is realised in the machine under trial, the deficiency must, necessarily, either be included in two direct measurements which should be identical, or must be included in one only, which must then exceed the other by the value of this known deficiency. It will be understood that if the machine examined suffers from both kinds of injurious effects the experiment will show the proportionate share which they bear in the deficiency.

Hitherto the direct measurement of the mechanical couple during the working of dynamo machines has been utilised only for the generators. It is true that in a generator the measurement is independent of the passive mechanical resistances (air, brushes, &c.); on the contrary in a recipient, the couple measured has to be augmented by the passive resistant couple. I have given an electric method for the determination of the passive mechanical power of machines. Besides, it will be seen that we have here to do only with the difference of two measures, which must both be augmented by this passive resistance, and which is thus eliminated from the result.

I suppose, then, the dynamo mounted upon bearings independent of the electro-magnets; these bearings support the brushes; the electro-magnets can move freely around the knife-edges which support them in the prolongation of the axis of the steps. I cause the machine to act as a recipient, working on a brake marking t kilogrammetres per second at the rate of n revolutions per minute, under a certain current. A certain effort will tend to turn the electro-magnets in the direction opposite to that of the rotation of the ring. I measure the couple, c, produced by a certain weight expressed in kilos by the length in metres of the arm of the lever when the inductors are brought back to their position of equilibrium before the movement. The work of this couple per second will be $\frac{2\pi c n}{60}$ kilogrammetres.

If to this work we add the passive mechanical work, we have the totality of the work reproduced mechanically by the recipient.

But the work, t, of the brake, with the addition of the same passive work, gives us a second impression for the total work mechanically recovered.

If the injurious phenomenon is of the dynamo-electric order, as M. Frolich supposes, and has its seat outside the circuit foreseen by the constructor, we have $\frac{2\pi c n}{60} > t$, and $\frac{2\pi c n}{60} - t$ will be the entire deficiency if this kind of effect exists integrally.

On the contrary, if our theory applies integrally to the machine under examination, we have $\frac{2\pi c n}{60} = t$, and in this case the deficiency must be ascribed to a cause of the electric resistant order—an increase of the metallic resistance of the induced wire, a counter-electromotive force of self-induction, this phenomenon of electric resistance having its seat in the arranged circuit of the machine.

It appears useful to point out this method to experimentalists, since it offers the advantage of an absolute distinctness of conclusion; it avoids, in fact, all reasoning from what passes in certain conditions to what ought to pass when these conditions are modified and is a perfectly direct method.—*Cosmos les Mondes.*

SHEEHY'S SWITCH BOARD FOR ELECTRIC LIGHT STATIONS.

AT stations for the production of electricity for distribution by means of a considerable number of circuits and to be used for industrial purposes, several dynamos are provided; and in well-appointed stations some extra ones stand ready to be applied at a moment's notice, to supply deficiencies which arise either from accident or extraordinary calls for more electric current. Furthermore, says the New York *Electrical World*, it often becomes necessary to switch the current of one dynamo from the circuit which it is on at the moment, or has been, supplying, to another circuit.

With currents of high electromotive force this switching is attended with some considerable danger from shock. Therefore, a handy apparatus which can be employed by the person in charge without danger, and with certainty and celerity, is a very desirable addition to the station; especially so in stations for supplying electricity to arc-light circuits.

Mr. Robert J. Sheehy, who has been long and favourably known in connection with the Brush system of arc lighting, has patented such an apparatus, and we herewith give some illustrations of it.

Fig. 1 shows a wooden frame carrying a series of horizontal metallic bars which are connected alternately with the opposite poles of the dynamos. A like number of bars perpendicular to these are connected with the terminals of the lamp-circuits. Metallic pins

project from these latter bars. Carriages, G, figs. 2 and 3, slide along the former bars, A, and carry arms, I, and spring sockets, *i*, *i*, which fit the pins, *f*, *f*. One of the handles, M, to each carriage is for the purpose of fas-

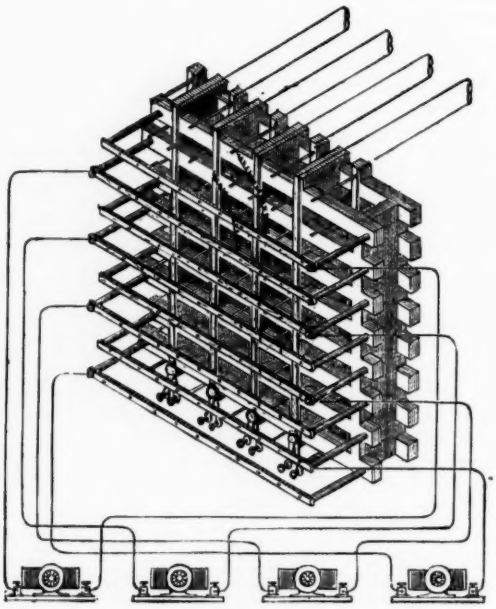


FIG. 1.

tening or loosening in placing or moving the carriage along the bar; and the other handle is for the purpose of shifting the socket arm, I, from pin to pin as desired. The switch handles, R, R, enable the placing of two or

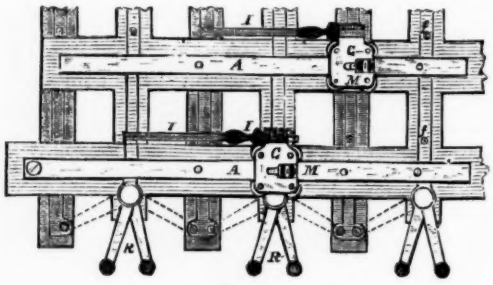


FIG. 2.

more circuits in series. In fact, all the necessary combinations and changes can be made in the circuits by means of this switch board.

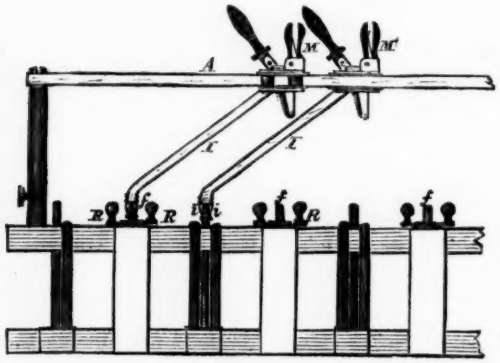


FIG. 3.

The distances apart, isolation, and insulations of the parts enable safe manipulation, where otherwise might be danger and the formation of destructive cross-arcs to burn up the switch board.

NOTES.

Electric Lighting.—We are informed that Messrs. Ganz & Co., of Budapest, are engaged upon the electric lighting of the nearly completed central station of the Hungarian States Railway in the above town. Seventy arc and 630 incandescence lamps are to be employed, and the machine for generating the electrical energy will be of similar construction to the firm's large dynamo, which was exhibited at the Vienna Exhibition for lighting the Exhibition Theatre.

The Edison Electric Company at Brockton, states the *Electrician* of New York, is trying the experiment of out-door lighting, by placing clusters of three 32-candle power lights on a couple of street corners. The lights are suspended on wires about 30 feet from the ground. 307 Edison electric lighting plants have been sold in the United States and Canada since May 31st, 1883, aggregating 59,173 lamps.

The French Government has decided to equip the lighthouse at Point Fouguet, on the south side of the mouth of the River Canche, with the electric light. Work began April 1, and the new light will be in operation about July 15.

Mr. T. H. Harrison writes to us to say that the work of installing the Gülcher system of electric lighting at the Crystal Palace has been, from the commencement, entirely under his supervision. Last week, we inadvertently in our reference to the Crystal Palace, gave the credit which by right belongs to Mr. Harrison, to Mr. G. C. Fricker.

On the invitation of Mr. J. D. F. Andrews, Woodside Electric Works, Glasgow, a large company last week visited the North German Lloyd s.s. *Ems*, in the dock at Messrs. John Elder & Co.'s yard, Fairfield, Govan, to inspect the electric lighting of that vessel. The system includes over 320 incandescent lamps and a masthead arc lamp. In the case of the small lights, Swan's lamps and Siemens' machines are employed. The wires are all completely hidden, but they are nevertheless arranged in such a way that they can be easily reached when necessary. For these lamps there is provided a new style of holder, which is at once simple and efficient. Each lamp has its own switch, which is entirely of metal; and it is provided with a lead wire which fuses in the event of the current being too strong. In the case of every set of about 20 lamps there is another switch, so that the lights can be turned on and off in groups as well as individually; and another lead wire, so that the leading wires may be protected from too strong a current. The whole system is such as to preclude the possibility of fire. Duplicate machines are fitted up to guard against any breakdown, and either of them can be started or stopped without interfering with the engine which drives them. The masthead arc lamp, of which Mr. Andrews is the inventor, is of about 5,000 candle-power concentrated in a single beam of light, that can be moved in any direction forward of the ship. In construction it is extremely simple, consisting merely of a cylinder and piston, the former being a coil of wire. The illuminating power of the lamp is so great that by means of it an object half a mile away can be clearly distinguished by the naked eye on a dark night. —*Glasgow Herald.*

Telephone Companies and the Post Office.—Mr. Sexton asked the Postmaster-General, last week, whether at any time he demanded royalty at the rate of one-tenth of the charges of the telephone companies for the insertion of advertisements in their own catalogues, printed at their own expense, for the use of their own subscribers; and, if so, on what ground this demand was made, and why, having been made, it was abandoned. Mr. Fawcett said that no royalty had ever been demanded from the companies for advertisements. The demand was in respect of a certain payment, and when the nature of that payment was explained the demand was at once withdrawn.

Provincial Telephone Company, Limited.—A general meeting of the members of this company is to be held at 11, Queen Victoria Street, on Saturday, June 14th, for the purpose of receiving the account of the liquidator, W. B. Campbell.

Telephony in Russia.—According to a *Times* telegram from St. Petersburg, the *Novoe Vremya* states that the War Department has successfully completed an experiment with telephones at the Sveaborg forts, and proposes the adoption of this means of communication in fortresses generally.

Telephony in Rio de Janeiro.—We have received a publication, issued by the Companhia de Telegraphos Urbanos of Rio de Janeiro, showing particulars of the company's telephone service, from which it appears that the connections number about 640.

New Telephone Company in America.—From an American contemporary we learn that "The Anti-Bell Telephone Company" is the somewhat sensational name of a corporation urging people to try the merits of an acoustic or mechanical telephone for private lines recently started.

Telephony at Wellington, U.S.A.—It is said that Wellington, Ohio, has more telephones in use in proportion to the inhabitants than any other place in the world. It is under the Central Union management, and the local manager is Mr. Houghton, editor and proprietor of the daily paper there. He reports one subscriber to every fifteen of the inhabitants, and the rate is the same as at all the principal cities under the management of the Central Union Company.

The Mackay-Bennett Cable.—The steamer *Faraday*, on Wednesday the 7th inst., laid the shore-end of the new Mackay-Bennett cable at Dover Bay, Nova Scotia, afterwards starting across the ocean and paying out the deep sea cable.

Cable News.—The Direct Spanish Telegraph Company's duplicate cable between Kennack Cove, Cornwall, and Bilbao, Spain, has been successfully laid, and is in perfect working order.

Direct United States Cable Company, Limited (of 1873).—Notice is given that a general meeting of this company is to be held at No. 4, Lothbury, on Tuesday, the 17th of June, for the purpose of having the liquidator's account, showing the manner in which the winding up has been conducted, and the property of the company disposed of, laid before such meeting. The liquidators, Messrs. John C. Griffiths and Henry Dever, request that creditors will send particulars of their claims on or before the 10th of June.

"Milking of Cablegrams."—In the House of Commons on Tuesday, Mr. T. P. O'Connor (for Mr. Labouchere) asked the Postmaster-General whether it was his intention to take any action with a view to make the milking of cablegrams to this country by the officials of cable companies illegal; and to ensure, as far as was possible, the secrecy of all cablegrams sent to and from this country over land lines belonging to the Post Office. Mr. Fawcett said it was important that the same protection should be secured for a telegram carried by a private company as was afforded to telegrams carried by the Post Office. But the question was not free from difficulty, and he would be glad to consider a clause to meet this point to be introduced into the Post Office Protection Bill. That bill, however, was blocked, and until it had been read a second time he could not lay any such clause upon the table.

Telegraph Wires in New York.—The New York *Electrician* states that the winter just past has been unusually severe upon overhead telegraph wires, although no single storm has wrought the extensive damage that has been caused by the sleet and snow of previous years. The Metropolitan Telephone and Telegraph Company of New York was the most seriously affected by reason of its immense system of light wires. A single storm caused about 900 interruptions, while on other occasions the derangement of the service was such that the superintendent would be willing to see the wires placed almost anywhere, even underground, if the result was otherwise satisfactory.

Telegraphy in Australia.—The Postmaster-General of Victoria has communicated with the Government of Queensland with a view to ascertaining on what terms they would construct a line of telegraph between Normanton and Daly Waters, with the object of removing the difficulty existing on the overland line.

The United Telephone Company v. the London and Globe Telephone and Maintenance Company.—This action, opened before Vice-Chancellor Bacon on Monday and concluded on Tuesday, was for an injunction to restrain the defendant company from manufacturing, selling, supplying, letting on hire, or using any telephonic apparatus manufactured according to the specifications of the "Blake transmitter," or generally from infringing the plaintiffs' rights. The plaintiffs charged that the defendant company had in their possession a large quantity of telephonic apparatus manufactured according to, or only colourably differing from, the inventions comprised in Blake's patent, and in particular that they had recently acquired a large number of Blake transmitters. They also asked for the delivery up to them of such apparatus, for an account of profits, and damages. The case for the defence was, that in May, 1882, the Attorney-General had, on the application of the plaintiffs, granted his fiat allowing the plaintiffs to disclaim certain parts of the specification of a patent granted to Mr. Edison which had been decided by Mr. Justice Fry to be bad. The fiat was granted on condition that no proceedings for infringement should be taken by the plaintiffs against the defendant company and others for using any instruments of the class included in the disclaimer. In June, 1883, the Attorney-General made an award exempting the defendants from any proceedings in respect of the 800 instruments which were the subject of the present action. The mounting of the electrodes in these instruments was admitted to be in accordance with Blake's patent; but in no other respect was the patent infringed. The instruments were lying unused in the defendants' possession. The defendants also denied the validity of the patent. In November, 1883, they offered to remove from each of the 800 instruments every part which constituted an infringement of the patent. Mr. Theodore Aston, Q.C., Mr. R. E. Webster, Q.C., and Mr. Moulton for the plaintiffs, asked for an injunction in the terms above stated, and that the instruments might be destroyed or delivered up to them. They would have been perfectly satisfied if the defendants had undertaken to export the instruments. Mr. Hemming, Q.C., and Mr. T. M. Goodeve urged, on the authority of "Minter *v.* Williams (4 'Adolphus and Ellis,' 251)," and of "Nobel's Explosive Company *v.* Jones ('Law Rep.,' 8, App. Cases 5)," that mere possession did not constitute an infringement, and that manufacturing or selling or using had to be proved in order to give a cause of action. The proceedings before the Attorney-General and the fiat also precluded the plaintiffs from the remedy which they sought. It was the plaintiffs' duty to have brought the Blake patent before the Attorney-General so that the questions might have been dealt with then. Mr. Moulton, in reply, said that as the fiat of the Attorney-General had nothing to do with the Blake patent and only dealt with Edison's patent, it had no application to the present case. The Vice-Chancellor said that the defendants were in possession of certain instruments which they practically confessed, and which were proved beyond the possibility of a doubt to be an infringement of the plaintiffs' patent. That in itself gave the plaintiffs a right to the injunction which they asked. The cases cited by the defendants had no ap-

plication to the present, and the decision in "Nobel's Explosive Company *v.* Jones" was founded upon totally different grounds. There was no force in the contention that the Attorney-General's fiat disposed of the question. The Attorney-General, acting in his judicial capacity, dealt only with the Edison patent, and permitted the plaintiffs to lodge a disclaimer of the Edison patent. But he had no authority to make any order with respect to the Blake patent, which was not before him. It turned out that the defendants had 800 instruments which were an infringement of the plaintiffs' patent, and they attempted to excuse that possession on the untenable ground of the Attorney-General's fiat. They also stated that they had no intention to use the instruments. If that were so, the injunction would do them no harm. The admission that the mounting of the electrodes was in accordance with the specification in Lake's patent of January, 1879, and the offer to remove from the instruments all such parts as infringed the plaintiffs' patent rights was an admission of the whole of the plaintiffs' claim. The plaintiffs therefore were entitled to the fullest protection he could give them. He did not, however, see his way to ordering a delivery to the plaintiffs of the offending instruments, but he would grant an injunction. Mr. Hemming urged that the offer of last November to dismantle the instruments and keep them dismantled would have given the plaintiffs all they asked. He therefore asked that the defendants might have their costs since that offer, or at all events that no costs should be given. The Vice-Chancellor said that Mr. Hemming always died hard, but he could not forget that the plaintiffs offered to allow the defendants to export the instruments. The defendants must pay the costs of the action, and the injunction must go in the terms asked.

Overhead Wires.—In the Queen's Bench Division of the High Court of Justice, on Tuesday, Mr. Justice Stephen gave judgment in the case of "The Board of Works for the Wandsworth District *v.* the United Telephone Company, Limited," in which the plaintiffs sought to obtain an injunction to restrain the defendants from retaining telephone wires without the consent of the plaintiffs in the position in which they were placed at Putney. The wires complained of crossed some of the streets, and the plaintiffs alleged that they were dangerous to the public. Mr. Justice Stephen, after dealing with the legal questions raised in the case, said that as to the allegation of nuisance, it appeared from the evidence that the wires were in good condition, and in the ordinary course of things, not likely to cause an appreciable danger, but that it was possible a violent storm might blow them down, just as it might blow down the chimneys to which they were attached, and that some had been blown down. He gave judgment for the plaintiffs with costs, but ordered that the injunction should not issue until after the final determination of the appeal, if the defendants wished to appeal. Counsel intimated that there would be an appeal.

We cannot but think that Mr. Justice Stephen, when delivering his judgment, was unacquainted with all the points involved in this important matter. That any great danger exists to the public by the use of overhead wires we deny, and we once more reproduce Mr. Preece's statistics, which prove more than all the controversy for and against, which is now attracting so much public attention. "During the last 30 years 400,000 persons have been accidentally killed in the United Kingdom, and of this number two accidents only can be traced to telegraph wires." Had Mr. Justice Stephen been aware of these facts he would probably have given a different verdict. It will be readily granted that the telegraph and telephone are now absolutely essential to the conduct of business, so, also, are cabs, omnibuses, bridges and railways. But who would think of abolishing the vehicular traffic of London because there are annually killed over 100 persons in our streets; indeed, the measures taken for *regulating* such traffic are by no means stringent, yet we have no outcry concerning the number of pedestrians who are knocked down and run over at least every week. Many of our bridges are built overhead, and we hear, occasionally, of fatal accident from a sudden collapse, still the only measures taken to secure the protection of the public from these dangers is, that of good construction in the first place, and periodical inspection by experts at intervals. As the *Standard* observes, "If the principle affirmed in the judgment that the local authority have power to prohibit the erection of telephone wires along the streets is to be upheld, it is obvious that the operations of telephone companies in all the great towns may be conducted henceforth under very embarrassing conditions. It is true that in many cases the local authorities might take an accommodating view of the matter, and might refrain from making use of the powers with which Mr. Justice Stephen's judgment invests them. We doubt if in practice this would amount to a prohibition of the telephone, for on all hands this most valuable addition to the resources of civilisation is increasingly appreciated, and public opinion, which is well informed as to its utility, would resent any unnecessary interference with it." We shall endeavour to make some further comments on this subject in a future issue.

The New Patent Law.—"L" writes to the *Times*:—"A day or two ago I deposited a provisional specification for a patent, and was told that as there had been nearly 7,500 patents taken out since the 1st January, and there was a great arrear of work before the Examiner, it would be three weeks or a month before I should know if my patent was accepted. This will be a great injustice to me, as I shall have better opportunities for pushing the patent during the next fortnight than I shall have during the ensuing 12 months, and it follows that because the office is shorthanded I must suffer. Surely this injustice to inventors should be at once remedied and a proper staff of examiners be appointed."

The Fourneyron Prize for 1883.—This endowment, for which the Paris *Academie des Sciences* is indebted to the celebrated inventor of the Fourneyron turbine, has been awarded, and we think justly so, to M. Marcel Deprez. The awarding committee state that M. Marcel Deprez has, by his beautiful experiments at the Chemin de fer du Nord, and by those at Grenoble and Vizille, practically demonstrated that the transmission of energy was there successfully realised for a power of 4 to 5-H.P. to distances of 8 and 15 km. Everything leads the committee to think that electrical transmission in the direction which M. Deprez pursues so successfully will be suitable for greater lengths and greater transmitted power. They therefore unanimously award to M. Marcel Deprez the Fourneyron prize for 1883.

Lightning Rods Wanted.—A letter from Seville reports that a terrible thunderstorm, which occurred on the 25th of April, did serious mischief to the Cathedral and its famous companile, known as "the Giralda." Great injury has been done to the picture, of considerable artistic value, over the southern entrance to the cathedral, the so-called "Puerta de los Palos," representing St. Sebastian before the Emperor Diocletian. It is reported, that as soon as Queen Isabella heard of the accident, she telegraphed that she would defray the expense of erecting lightning conductors out of her private purse.

The Electrical Transmission of Energy.—The grand prize of mathematical sciences is offered this year by the French *Academie des Sciences* for the most successful memoir on the following question: "To perfect in every important point the theory of the application of electricity to the transmission of energy." The prize will consist of a medal of the value of 3,000 francs. The memoirs must be remitted to the Secretariate before the 1st June, 1884, they must bear an epigraph or device, repeated in a sealed

envelope containing the name and address of the author. This will not be opened unless the memoir to which it belongs is successful.

We learn from a French Exchange that a new application of the electrical transmission of energy has been working regularly and very successfully for some months past in a coal mine in the neighbourhood of Vienna. The two dynamos employed are Gramme machines; the generator gives a current of 15 ampères, with an electromotive force of 500 volts. The receiver produces about 8 H.P., at a distance of 1,900 metres, and actuates through friction wheels a pump, which delivers 300 litres of water per minute at a height of 60 metres, and through a conduit 800 metres long. Before the adoption of the electrical machines a steam engine was used, the radiating heat from which rendered it very uncomfortable to remain in the gallery. The employment of dynamos has caused the temperature to fall about 14 degrees. It is also said that the consumption of fuel is considerably reduced.

American Institute of Electrical Engineers.—The committee on organisation called a meeting for Tuesday, the 13th inst., when a complete scheme of organisation was to be submitted. The committee recommends that professional electrical engineers and electricians, and all persons interested in electrical enterprises or studies, shall be eligible for membership or associate membership; that the entrance fee shall be five dollars, and the yearly dues ten dollars; that the affairs of the institute be managed by a board of officers, called the council, to consist of a president, six vice-presidents, twelve managers, a secretary, and a treasurer, and that this board shall elect and determine the status of members—whether as members or associates. It also recommends that three or more general meetings be held each year; that the office of the institute be established in new York city; and that headquarters be established at or near the International Electrical Exhibition buildings, in Philadelphia, during the exposition, from September 2nd to October 11th, 1884, for the use and convenience of the members.

Thunderstorms.—M. Cochery, the French Minister of Posts and Telegraphs, has communicated to the French Academy of Sciences an elaborate report on the strokes of lightning which were observed in France during the first half of last year—that is, from the beginning of January to the end of June. The report is the first of its kind, and is due to a resolution of the international conference on electrical units held at Paris in 1882 expressing a wish that an international system of observations on lightning strokes should be organised, each country collecting its own *data*. M. Cochery framed a list of questions which were distributed to all the postmasters in the various departments, and such agents of railway companies and others as were willing to assist in the work. The questions embraced the nature of the stroke, damage to life and property, and a general description of the conditions and effects. The result is the interesting document presented to the Academy, from which it appears that in January there was one stroke injuring a man who carried an open umbrella with metal ribs. In February there were no strokes at all. In March there were four strokes damaging unprotected buildings and a high oak tree. In April there were also four strokes, injuring several persons, some poplar trees, a weathercock, a bell tower, and an isolated building. In May there were twenty-eight strokes, killing two men, seven cattle, three horses, and injuring several persons and two horses, as well as numerous trees and houses. The trees were oaks, chestnuts, poplars, and several of the strokes attacked the chimneys of the houses. It is notable that a gilt wooden figure of Christ in front of the church of Bonsecours (Seine-Inférieure) was struck, although the church has a lightning rod on it. During the month of June the total number of strokes largely increased, there being no less than 113, or from three to four a day. The daily number varied during the month, but was, if anything, larger at the end than at the beginning of the month. Seven men were killed; about forty persons, men, women, and children, were injured. Some seventy animals were killed, including fifty sheep and a dog. Many trees—oaks, poplars, elms, firs—were struck. A common object struck is the bell of some church, the chimney of some house, or the weathercock of a barn. Some of the strokes observed were received by the lightning rods of buildings, and did no damage, except perhaps fusing the point of the rod. On the other hand, several serious accidents to buildings, and in one case death to a horse, occurred within a comparatively short distance of a lightning rod (from fifty to eighty metres). Isolated trees and animals under them appeared to have suffered most. Rain and hail accompanied most of the storms.

Bartolozzi Engravings Applied to Decorative Art.—At all times we have the greatest satisfaction in hearing of any new means tending to beautify and render the decoration of our homes more in accordance with the dictates of artistic feeling generally, and particularly so when that tendency lies towards a pure, elegant, and refined style of art, where thoughtful workmanship and simplicity of arrangement add such a nameless and delightful charm to its own intrinsic beauty and merit. It is with much pleasure, therefore, that we notice the endeavours of the eminent firm of upholsterers, cabinet makers, and decorators, Messrs. H. & J. Cooper, of 8 and 9, Great Pulteney Street, Golden Square, W., the same firm who so tastefully fitted some of the Edison rooms at the Crystal Palace Exhibition, 1882, to introduce into furniture and other decorative methods, the soft and delicate engravings of the school that flourished under the hands of F. Bartolozzi, R.A., and his pupils and followers. They claim—and the exhibition now on view at their above address justifies their opinion—a large measure of success in the application of the "red dotted manner," to the ornamentation of useful articles as well as to decoration alone. They have a room fitted up to show the numberless ways in which the style can be introduced. The engravings are printed on a cream satin, giving a lustre and softness which is wanting in paper copies, and making them available for purposes where paper would be useless. The greatest credit is due to Messrs. Cooper for the trouble and expense they have incurred in getting together this collection of the original copper plates. These were naturally much worn, but by dint of careful treatment in the electric bath, after just as much restoration as was absolutely necessary, accomplished by most expert, careful, and reverent handling, they have succeeded in producing a valuable set of impressions on satin belonging to what will always be one of the most pleasing and attractive schools of the engraver's art. Had the exhibition been lighted by incandescent lamps, as we believe the original intention was, and abandoned only for want of space, the warm and lustrous reds and browns used in the printing would have been still more enhanced in all their softness and purity of tint. We advise all lovers of Bartolozzian art not to fail to see the exhibition, a visit to which will be well repaid.

The Society of Telegraph-Engineers and Electricians.—The next meeting of the society will take place on the 22nd instant, at the Institution of Civil Engineers, 25, Great George Street, when the following paper will be read:—"The Electrical Congresses of Paris," by W. H. Preece, F.R.S., past-president.

Action against the Pilsen-Joel and General Electric Light Company, Limited.—Before Mr. Justice Pearson, on Friday, Mr. John Taylor moved for an injunction to restrain the Pilsen-Joel and General Electric Light Company, Limited, from applying any part of their assets to the purchase of their own shares, and in particular from applying money of the company in pay-

ment of a sum of £1 3s. 4d. per share, or any other sum for the surrender or acquisition of fully paid up shares as proposed, or expressed to be authorised, by a resolution passed at an extraordinary meeting of the company on the 6th of March last. The capital of the company, as stated in the memorandum of association, was £200,000, divided into 40,000 shares of £5 each, all of which had been issued. Of the said shares 1,200 had been issued to the vendors or their nominees as fully paid up shares, and the remaining 28,000 had £2 10s. credited as called up. The plaintiff was a holder of 250 fully paid shares, and the resolution which had been passed by the company, and which he complained of, was to the following effect:—"That notwithstanding anything contained in the articles of association, the directors be authorised and directed to carry out the following compromise and modification of the agreement with the vendors 'the Union Electric Light and Power Company'—that is to say, that the directors shall take a surrender of the 11,530 fully paid-up £5 vendors' shares which were allotted to the Union Electric Light and Power Company in consideration of the purchase, and of such of the 470 like shares allotted to their nominees as can be obtained; and that the directors do pay in lieu and consideration thereof a sum not exceeding the amount of £1 3s. 4d. for each of such shares, and that as hereby modified the said agreement with the vendors be confirmed. Secondly, that if an order of the Court be obtained for confirming the resolution, the capital of the company be reduced as follows:—First, by cancelling the 12,000 fully paid-up vendors' shares when the same shall be surrendered, or such of them as shall be surrendered. Next, by cancelling the sum of £1 per share on the 28,000 shares of the company with £2 10s. called up thereon, and also on any fully paid-up vendors' shares which might not be so surrendered as being capital which had been lost or was unrepresented by available assets, and further, by reducing the amount liable to be called up on the 18,000 shares with £2 10s. called up thereon, from the sum of £2 10s. per share to £1 10s., and that the memorandum of association of the company be modified so as to carry into effect the resolution." Mr. Cozens Hardy, Q.C., and Mr. Beale appeared for the plaintiff, and contended that the resolution was *ultra vires*, and the company had no power to alter their articles of association so as in effect to purchase the shares of the company out of the moneys of the company, and further, that if not *ultra vires*, the scheme proposed to be carried out was inconsistent with the interests of the company. Mr. Davey, Q.C., and Mr. Rawson appeared for the company, and contended that they had full power to pass and to carry out the terms of the resolution. Mr. Justice Pearson said it appeared that the resolution which had been come to by the company was carried at a meeting which was duly advertised to all the shareholders, and there had been no secrecy in the transaction. All the Court had now to decide was, whether the directors had successfully carried through so much of the scheme as affected the purchasers of the 12,000 shares. The directors considered that the scheme was a beneficial one for all the shareholders, and not having power to carry it out this resolution was passed for the purpose of giving them the power. The first objection was, that until the articles were repealed, there could be no resolution passed for altering the terms, and that there should in the first place have been a resolution for effecting such repeal, but his Lordship's opinion was that the resolution as framed, commencing as it did with the words, "Notwithstanding anything contained in the articles of association," was sufficient to show the intention of repealing so much of the articles as prevented the directors from making any other terms. Then, he could see no reason why both matters should not be done under one resolution. There might well be two forms to go through, but still they might both be contained in one resolution. This decision he considered to be in conformity with the authorities which had been cited. His opinion was, that the resolution sufficiently expressed the intention to alter the articles, and to substitute in lieu thereof the resolution which had been passed at the meeting of the shareholders. Under these circumstances he should decide that the directors had power to carry out the resolution, and the motion must be refused with costs.

Notice is given that a petition for confirming a resolution reducing the capital of this company from £200,000 to £85,480 was, on the 28th of April, presented to Her Majesty's High Court of Justice, and is now pending; and that the list of creditors is to be made out as for the 16th of June.

Large Blowpipes.—In the employment of large blowpipes for brazing, repairing machinery, retort and furnace heating, &c., it has been found wasteful and unsatisfactory to use illuminating gas, whatever its quality, for large work, without a blast of air under pressure, owing to the difficulty and uncertainty of making a perfect mixture of air and gas—the usual result being a smoky and unsatisfactory flame of low temperature, giving a very low duty. Fletcher's blowpipe has been made to remove this difficulty, and it is said to be exceedingly useful for repairs of pipes and joints, without the necessity of stopping or pulling

BLOWPIPE FOR SMITH'S BELLOWS OR FAN

machines to pieces. The apparatus here illustrated requires a smith's bellows or good fan and a 1½ inch gas main. It will burn up to 300 cubic feet per hour, and will heat a 3-inch wrought-iron pipe to brazing heat in five to six minutes. If used under a boiler in series they can be placed side by side at the upper part of the flue, and each burner will give steam for about 4 H.P. indicated in an ordinary boiler. A second type is of the same power as that described, but can be used with a foot blower, thus enabling it to be taken and used in positions where an ordinary smith's bellows would be a matter of great difficulty; with this, a flaw in a pipe can be brazed in any position where it can be seen. The blowpipes, specimens of which have been sent to us, do not get hot, and may easily be held in the hand, although so small.

Ransomes, Sims and Jeffries, Limited.—Messrs. Ransomes, Head and Jeffries, of the Orwell Works, Ipswich, inform us that owing to the continuous extension of their business they have converted their partnership into a private limited company, which has been registered, and will be henceforth carried on under the name of "Ransomes, Sims and Jeffries, Limited." We may add for the information of those dealing with the firm that the business management will be continued by the partners of the late firm, viz., Messrs. R. C. and J. E. Ransome and J. R. Jeffries, who, together with Mr. W. D. Sims, and members of their respective families, are the shareholders in the new company.

Personal.—Mr. Frederick C. Phillips, of 2, Victoria Mansions, Westminster, S.W., asks us to state that he has severed his connection with the Hammond Company as managing electrician, and that he now intends practising as an electrical and consulting engineer at the above address.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Telpherage Company, Limited.—The annual return of this company, made up to the 31st of March, was filed on the 3rd inst. The capital is £50,000, divided into 2,500 A and 2,500 B shares, of £10 each. 1,530 A and 608 B shares have been allotted, and upon the former £7 per share has been called; the latter being issued as fully paid up. The calls paid amount to £10,680, leaving £30 unpaid. Registered office, 53, Old Broad Street.

Lyons Electrical Power Storage Company, Limited.—The annual return of this company, made up to the 1st inst., was filed on the 7th inst. The capital is £500,000, in £1 shares; 16,999 shares have been taken up, and 76,000 (fully paid) have been issued to the vendor. Upon the former shares, 10s. per share has been called. The calls paid amount to £16,969, and £29 10s. remains unpaid. The total amount for which share warrants comprising 1, 5, and 10 shares each, are outstanding is £3,000, which have been issued since the last return was made. As compared with that return, the paid up capital has increased to the amount of £32,964 10s. Registered office, Mansion House Chambers, 11, Queen Victoria Street.

Railway and Electric Appliances Company, Limited.—The second return of this company, made up to the 2nd inst., was filed on the 9th inst. The capital is £500,000 in £1 shares. 170,232 shares have been allotted, and upon 91,732 of these 12s. 6d. per share has been called, the remaining 78,500 shares being fully paid. On 81,809 shares £51,130 12s. 6d. has been paid, and upon 9,923 shares £1,651 7s. 6d. has been paid. Upon 9,923 shares the sum of £4,550 10s. remains unpaid. Since the last return was filed, in August, 1882, 66 ordinary and 16,500 fully paid shares have been issued. Registered office, 31, Lombard Street.

DISSOLUTIONS OF PARTNERSHIP.

Barnes, Roland Isaac, and **Walker, Frederick Howard,** electric engineers, Rocliffe Street, Islington, carrying on business as the Vulcan Manufacturing Company.

Wright, Frank, and **Mackie, Matthew William Walbank,** electrical and mechanical engineers, 57, Gracechurch Street, London.

CITY NOTES, REPORTS, MEETINGS, &c.

Brush Electric Light Company of Scotland (in Liquidation).

THE following is a report, sent us by a correspondent who was present, of a meeting of this company, held on the 29th ult., from which accredited representatives of the Press were excluded:—

Liquidators—The Hon. Ashley Ponsonby in the chair; Thomas Dickson and Robert Ewing.

The Secretary to the liquidators read the notice calling the meeting.

In opening the proceedings, the Chairman briefly invited the shareholders to put any questions they desired previous to the passing of the accounts.

Mr. Peter Cunningham, who rose to address the meeting, said as this was probably the last time they would be called together, he wished to state the causes which, in his opinion, had brought them to the position they were in. On 28th of September last a meeting was called and held to appoint liquidators for the purpose of winding up; the directors gave in, on that occasion, a printed statement, in which they stated their reasons for advising the course they were about to adopt, viz., that "they had had very great difficulties to meet in Scotland, owing to the excellence of the gas, and to the citizens not caring to displace it for electric light;" "that they were, indeed, received in such an unfriendly spirit by all the town councils they tried, that there was no hope of their progress;" and that the action of the Board of Trade's provisional orders was such that it might have been supposed the Act was made in the interest of the gas companies. These reasons were not in consonance with those they had previously given for establishing the company, such as that Scotland was the best place for the electric light on account of the cheapness of coals, &c.; but he believed the real causes that brought them together that day, and which were carefully kept in the background, were, 1st, the enormous amount paid for the concessions; 2nd, the crushing expenditure; and, 3rd, the mismanagement. Now, he would deal with facts only, and everything he said, and any charge he made, would be taken directly from figures and written statements. They started as a company with actual money paid down of £55,000, being £2 10s. per share on 22,000 shares; of this amount they were deficient, or had lost over £35,000. They had paid £15,000 for their concessions, which left £40,000 for working capital, and, in addition, 8,000 fully-paid shares of £5 each, making £40,000, were given to the vendors. The effect of this arrangement was, that in order to pay their shareholders 5 per cent., they had to earn 10 per cent., and therefore they had to actually pay away half their profits in addition to the £15,000 in cash already in the pockets of the vendors. Now, he ventured to say that none of the directors in their private capacity would have entered into such an arrangement; and not only did they, the shareholders, pay this enormous sum cash down, and mortgage their future profits to the extent of one-half, but the directors, in their imprudence and want of judgment, were so careless of their interests that, in the event of the company liquidating, they made no provision against those shares having a claim on any assets that might be left for division amongst those who had provided the capital, and the result was, that the vendors had, in virtue of those shares, come down upon them for a sum of £10,000, their *pro rata* division. By the accounts which were made up to 31st July, 1883, representing a period of about 14 months, and presented at the meeting of 28th September ultimo, what might be called the ordinary expenditure, amounted to £8,790, which was from 20 to 25 per cent. of their capital. It was shown in that document that they had attempted some small lighting in Scotland—he presumed it to be at Edinburgh—which cost £1,560, and resulted in a loss of £956. It seemed to him that the directors understood best the business to which they had been accustomed, the paying of law charges, directors' fees and office expenses, which in its "sweet simplicity" was suited to the comprehension of the meanest intellect. The ordinary expenses, which are taken from the company's account of 31st July, 1883, are as follows:—law expenses, £2,360; salaries, £2,177; directors' fees, £1,537; rent, law charges, £1,399: loss on installation, £956; depreciation plant, £362; total, £8,790. He was surprised at the excessive amount of the fees paid to the directors, and that the shareholders had no voice in fixing these fees; he found that the directors had fixed their own remuneration at the rate of £300 per annum to each of them, as shown in the articles of association. He considered that these fees were enormous for a company such as theirs; he knew that this was a great deal more than the directors of the Glasgow and South-Western Railway Company, with a capital of over £12,000,000, received. Mr. Dickson, who was their managing director, and received £500 a year salary, had a business of his own, and he was only able to give the company such of his time as he could spare from his private affairs. It was, moreover, impossible for a company having its business in Scotland to succeed with a large staff eating up its capital in London in useless expenses. The directors had spoken in their past meetings of the candour with which they had treated the shareholders, but he remembered that in regard to the Lane-Fox lamp it was stated in the prospectus that the company had bought the exclusive right for Scotland; it, however, transpired subsequently that they had not this exclusive right; on the fact becoming known the chairman stated that it was of no great commercial value. Since this occured some of the shareholders had brought actions against the company for a return of their money, on the ground of this misrepresentation in the prospectus, and the directors called the meeting of 28th November, 1882, for the purpose of passing a resolution authorising them to contest these actions. The resolution was as follows: "That this meeting, having heard the statement of the chairman expresses its confidence in the board of directors, requests them to carry on the business of the company, and to oppose all hostile actions brought by the shareholders against the company," which was so ingeniously drawn that it was intended to cover a great deal more than appeared on the surface, and as a further inducement to them to pass this resolution, they were told by the directors that what they considered "a really flourishing business would be thrown away" if the resolution was not passed. The shareholders passed this resolution on the faith of the directors' statements. They had not heard one word from the directors from that day to this of these hostile actions, but from an examination of the accounts he had made he would enlighten them as to how these actions had resulted. They would see in the accounts which are made up to 31st July that instead of the capital being put down at the value of 22,000 shares, with £2 10s. paid, it was only put down at 21,700 shares, or 300 shares short; the difference of 300 shares he had found was the amount held by those shareholders who were sharp enough to bring the action against this company; the truth was that the directors found, upon consulting counsel, that the error which they had made so light of was of so grave a nature as to vitiate the whole contract on which the company was formed. So

that gentlemen would be surprised to hear that all of those who are allottees in this company are similarly entitled to a return of their money with interest and legal expenses. The directors, who had affected to treat them with candour, should have called them together and put the whole matter before them before returning this money. But not a word was said; and in the accounts which were placed before them, instead of these transactions being clearly recorded as they were in the books of the company, they were put down in a way to render them utterly obscure, and with the result of concealing their true nature from the shareholders. Clearly the transaction amounted to the reduction of their capital or to the purchasing of its own shares by the company, both of which are prohibited by the Company's Articles of Association. He came now to the accounts presented to them at this meeting, and he reminded them that on 31st July, 1883, they had cash in bank and in hand of £31,286. The accounts now before them, instead of beginning on 1st August, was commenced on 16th October, so that between these two dates they had no accounts whatever. On the latter date they began with cash in hand of £30,601, so that there is a deficiency of £685, and if interest on the £31,286 is added, the deficiency will be brought up in round numbers to £1,000. He did not suggest that the money had been improperly made away with, but the shareholders were entitled to have an account of how their money was spent. He had a conversation with Mr. Dickson, who claimed great credit for the speed with which the company had been wound up, but when gentlemen recollected that at the time the company went into liquidation on 29th September they had cash in bank and hand of £31,286, against which there were outstanding claims, according to that account, of £1,960, say £2,000, and this amount, deducted from £31,286, left a balance in hand of £29,286 available for distribution at that time. Now, after the lapse of seven months, they have received only £29,171, so that they would have been better off if they had divided at once the £29,286. It was, therefore, evident that the expedition shown in liquidating some £4,000 worth of plant resulted in further charges in salaries, rent, fees, and law charges of £1,281; and if to that is added £1,000 already referred to as deficient, and the balance now in hand of £1,695, of which he did not suppose much would be returned, they had the whole of the plant and machinery eaten up, in other words it has cost £4,000 to liquidate that amount of plant. Therefore they must be very grateful to Mr. Thomas Dickson for the expedition he had shown as a liquidator. He (the Speaker) had charged the directors with very grave errors of judgment, but he did them this justice, and he did it with very great pleasure, that, so far as he had been able to see, from the birth of the company till the present moment they had, with the exception of the managing director, never dealt in a single share. Mr. Thomas Dickson told him, with the air of a man who felt aggrieved, that he applied for 500 shares in the company which the directors cut down to 100 odd; but he, Mr. Dickson, did not apply for these shares to show his faith in the company by keeping them, for he found that out of the 100 odd shares allotted to him sixty were sold very shortly afterwards—sold at a time when the shares were at a large premium; and further, shortly before the meeting of 29th of September, when they were called upon to liquidate, say about the middle of the month, he found that Mr. Thomas Dickson began to buy shares till he held over 500, so that Mr. Dickson, when he said he was attending to their interests, was not neglecting his own.

Mr. Thomas Dickson said that Mr. Cunningham was not aware of the difficulties of the liquidation, that they had to make arrangements with the £5 shareholders and to gain their consent for the abatement of the claim of £2 10s. per share which they held they were entitled to prior to the payment to the £2 10s. shareholders of any of the money to be distributed. He did not know why Mr. Cunningham had made such a personal attack on him, whom he did not know; he, Mr. Dickson, had bought some of the shares at a very high price, and they were a loss to him; he would also remark that the information was open to all.

Mr. Cunningham pointed out that the arrangement with the £5 shareholders had been come to previous to 28th September and before the liquidation commenced, and he quoted, in proof, from Mr. Dickson's speech on that occasion, in which he said "that the Anglo-American Brush Company consented to cancel 2,850 of the £5 shares held by them, they taking back their patent," and further "that he (Mr. Dickson) did what he could with the other holders of the £5 shares; and in the result friendly arrangements had been virtually come to respecting altogether nearly 6,500 of these shares, leaving very few holders of the £5 shares to be settled with," so that coming to terms with £5 shareholders could not have been the reason that the liquidation lasted over seven months.

Mr. Walker, who supported Mr. Cunningham, complained of the excessive law expenses, and he was of opinion that they should be taxed.

Mr. Thomas Blair, after complimenting Mr. Cunningham on his able speech, said he could not follow him into the attack he had made on Mr. Dickson, whom, he thought, had directed the affairs of the company with discretion and was deserving of their support.

Mr. Ladd, a former director, thought the liquidation had been satisfactory, and proposed that the liquidators should receive £300 for their services, which was duly seconded.

Mr. Cunningham moved an amendment that the amount should be reduced to £150 and on this being seconded, Mr. T. Blair proposed that their solicitor, Mr. Harold Brown, should say what was in his opinion a fair amount; this proposition Mr. Cunningham characterised as a proposition of child-like simplicity.

On the amendment being put the votes were even for and against, and eventually the chairman gave his casting vote in favour of the original motion.

The proceedings, which were of a stormy character, were thus brought to a conclusion.

Railway and Electric Appliances Company, Limited.

[IN our issue of April 26th we published a report of the above company's meeting, and last week inserted a letter in our correspondence columns anent the same matter. We have since received the following communication.—EDS. ELEC. REV.]

Every effort has been made to cause it to appear that I have endeavoured abusively, and without reason, to call in question the actions of some of the principal persons connected with the company, and, furthermore, that my object in doing so was entirely selfish and antagonistic to the interests of the shareholders.

In answer to all such attacks and insinuations I submit that my object is to save my own property, which is represented by shares, and is therefore of exactly the same character as that of every other shareholder who occupies an independent position and is not liable for irregularities personally or through his colleagues. I will place at the disposal of the shareholders of the company, and invite their most thorough examination and criticism of, the evidence which has forced me in the protection of my own interests (which are solely represented by shares and in common with other shareholders) to oppose the so-called "terms of compromise," which I do not hesitate (without fear of proof to the contrary) to condemn as exclusively in individual interests, and in every way prejudicial to the shareholders of the company.

Some of those who were mainly instrumental in promoting the company have introduced themselves into the management of the company's affairs, and the printing press has been freely used to make it appear that the terms of compromise are beneficial to the company.

Intermediaries came forward at the moment when the directors who had brought action against the promoters found themselves saddled with the costs of the petition for liquidation.

These intermediaries are the intimate friends and colleagues of those who promoted the company, and if testimony sworn to by the friends of the Duke of Manchester and the London directors is of value, they are not only to be beneficially interested in the terms of compromise, but have much to fear if that compromise is rejected and the just claims of the shareholders are enforced.

I submit that facts such as these constitute a grave *primâ facie* case against the disinterestedness of those by whom this proposed compromise has been arranged, and when it is remembered that at the recent meeting *absolutely no attempt was made to disprove such facts by the offer of any counter evidence*, their importance may be fully estimated.

It is worthy of the shareholders' most serious consideration that not one of the statements made in the pamphlet and circulars with reference to the conduct of some of the directors, the promoters, and others associated with them in the company's affairs, has been refuted nor has there been any attempt made at an answer.

These gentlemen have contented themselves with vague and entirely unsupported denials of the accuracy of some of the statements, and instead of endeavouring to satisfy the shareholders in whose names they are supposed to act, they have resorted to the feeble and miserable device of evading facts, with personal abuse and insinuations, without even having truth as a base.

The speeches of Colonel Jackson and Mr. W. A. Smith at the meeting on the 18th April were confined to characterising the circulars and pamphlet as "amusing documents" and "very abusive," to a plausible but disingenuous criticism of the balance-sheet which, however, was denominated "a mass of absurdities," and to an attack on my motives by means of the improper use of a private letter and by some false statements about my connection with the Williams Company. These things I shall deal with in their place, but before noticing what is personal, I shall call attention to what concerns the shareholders in order to expose Colonel Jackson's attempt to divert their attention by mere side issues from what is of vital importance.

The shareholders must not be cajoled by any of the inspired notices which have appeared in some newspapers into the belief that Colonel Jackson's policy has carried the day. On the contrary, two very important obstacles prevent this, viz., first, the required majority of votes was not obtained to sanction the alteration of the articles of association, without which the directors are powerless to carry through the terms of compromise; and second, at present an *interim* injunction exists in the Court of Chancery, restraining them from using the assets of the company in the way proposed under the said "terms of compromise of litigation."

It is to be hoped that the shareholders will adopt vigorous measures to protect their rights and property, and it is in order to aid them in this direction that I again call their attention to the facts of the case as already laid before them in the circulars and pamphlet regarding—

1. The promotion of the company, with its attendant irregularities.

2. The existence and management of opposition companies by some of the directors and promoters of this company.

3. The character of the arrangement with the National Electric Company.
4. The questionable use of some of the shares of this company.
5. The position of Mr. W. A. Smith and others in connection with the affairs of the company.
6. The claims of the shareholders against those who have caused them loss.
7. The irregularity of the meeting in August, 1883, and the character of the committee since acting.
8. The beneficial effects of the proposed compromise to the promoters and their friends, and this regardless of the future of the company, or the cost to the shareholders or their rights.
9. The disastrous loss of £55,000, which the shareholders must sustain if terms of compromise proposed by the directors are recognised by the shareholders.
10. The value of the railway patents and other assets possessed by the company.

All the statements in the pamphlet and circulars bearing on these matters may be held as established facts as they are unanswered.

Colonel Jackson's only argument in favour of the compromise was that it would reduce the nominal capital of the company, and would prevent the expenditure of money in litigation.

I repeat that this argument is utterly fallacious, because it does not tell the whole truth, for he omits to mention that *along with the extinction of the capital in this way goes necessarily the extinction of the very assets which the company was formed to acquire and work.*

The statement about expenditure of money in litigation is no more trustworthy, because it conceals the fact that if it is the litigation against promoters and others which is meant, the shareholders are pretty certain to recover their costs and something more from it, while if it is the litigation with the dissentient shareholders which is alluded to, the surest way to lose costs, as well as the whole amount involved in these actions, is by adopting Colonel Jackson's policy, which is solely beneficial to others than the general body of shareholders.

I do not deny that it would be a good thing to reduce the share capital of the company by the extinction of £50,000 fully paid shares, but I maintain that *this should be and can be done without parting with the property of the company.*

In this case there would be "assets" in existence which would be "freed from a very heavy charge" upon them, and there could be "profits" upon which a reduced capital would be "entitled to claim."

In any other view the arguments and policy advanced and advocated by Colonel Jackson are entirely delusive, and the fact that the compromise means plainly a direct loss to the shareholders of £55,000, besides the entire liberation of those who are at present claimed to be liable to the shareholders for loss and damage, is enough to prove that the scheme of compromise as advocated by Colonel Jackson is, from the shareholders' point of view, more than "a mass of absurdities." It is to be hoped that Colonel Jackson and his friends are not deceived into supposing that such an arrangement can be allowed.

As to my balance-sheet, which shows the results to the shareholders by rejecting the terms of compromise and realising the just claims of the shareholders, Colonel Jackson has announced that the Williams Company is without capital and is in liquidation, and he unhesitatingly affirms that it would not only be "very difficult" to get £29,500 from a company in this position, but also that "it is important to know that £29,500 cannot be got out of the Williams Company." But does not Colonel Jackson himself propose to get £24,000 out of that company under the "terms of compromise of litigation?" How, then, does *he* expect to get this amount from "a company which has no capital and is in liquidation?" Are we to apply his own argument to himself and assume that, after all, the "terms of compromise" are only a sham? The truth is that he knows well where £24,000 of the £29,500 referred to in my statement are to come from, and as to the balance, he knows also that the liquidator of the Williams Company retains in his own hands £5,000 more, which was received from the Railway and Electric Appliances Company, the particulars of which he did not expose at the meeting. It is therefore evident that the assets of the Williams Company are good for £29,500, the amount named in my balance-sheet as recoverable from it. Colonel Jackson also stated that the National Company has only "£8,000 or £9,000 of capital left," or, in other words, that the capital of this company is only £1,000 or £2,000 more than the sum it received in cash from the Railway and Electric Appliances Company, and he calls upon me to "explain how £22,000 are to be got out of a company that has only £9,000." I therefore submit Colonel Jackson has omitted to notice that under the "terms of compromise" he credits that company with assets sufficient to purchase £15,000 worth of property from the Appliances Company, and as he admits the existence of other £9,000, it is evident that in criticising adversely my balance-sheet, Colonel Jackson conceals the true state of that company's affairs.

Colonel Jackson does not agree with me as to the possibility of recovering damages from the promoters and others. He could not be expected to accept my view readily under the circumstances; but I confidently submit, if the shareholders of the company will take in hand the management of their own affairs, the force of circumstances may be found sufficient to induce a material change of views in Colonel Jackson and probably in others also. In presence of such facts as are at the command of the shareholders, it is not difficult to enforce a recognition of their just claims, and prevent the loss of £55,000, which would be the result under the proposed terms of compromise. This is a case not without precedents, as must be well known to some of the directors, and therefore the solemn warning of Colonel Jackson about "ruinous costs and loss of assets" is the mere conjuring up of a spectre to terrify the shareholders. Why he should bring in "loss of assets" in this connection it is difficult to imagine, because that is exactly the result of the compromise which he so ardently advocates. Even failure in these actions will be no worse than the results from carrying out the terms of compromise.

Colonel Jackson prophesied boastfully that failure would be the result of the attempt "to set aside the terms of compromise," and he announced in the same spirit that the number of proxies held by the directors was sufficient to "outvote and checkmate the attempt to govern the affairs of the company" in a way which he considered as likely to be "to its detriment." It is therefore fair to analyse the measures adopted to secure the fulfilment of Colonel Jackson's predictions.

It appears from the poll that the total number of shares voted in support of the "terms of compromise" was 57,917, but that of these, 40,450 are the very shares which in their report the directors told the shareholders had been assigned to Colonel Elliot and Colonel Jackson in trust for the Company. I submit that such shares held in trust for the benefit of the company should not be used against the shareholders of the company, but Colonel Jackson did not hesitate to employ them and, solely by their use, to secure his seat upon the board, to prevent the removal of Mr. Smith, and to carry the terms of settlement with his friends which are disastrous to the shareholders, although Colonel Jackson had previously denounced these shares as "an incubus" and as "that element which presses most against the interest of the capital of the company." He did not scruple to urge that the possession of fully paid-up shares and the voting of them by others was directly antagonistic to the interests of the shareholders, and yet he is found using shares obtained in the promotion of the company, and by such means only is it possible for him to swamp the shareholders holding ordinary shares, who oppose his policy. He may urge that some ordinary shares are also found in the majority. That is true; but of these ordinary shares so voting 11,644 were held by the vendors and promoters, and those especially connected with them, while 3,700 more were held by the directors and their relations. If these numbers are added together and subtracted from the total number voted in favour of the compromise resolutions, there will appear 2,123 as the number of presumably independent shares voted for these resolutions, but in this number is included probably the shares of Mr. Arrol, one of the directors.

This result shows conclusively that outside of those who were directly concerned from personal and pecuniary reasons, the general body of shareholders gave no support to the policy which sacrifices both their property and their just rights.

Even if we allow that the number, 2,123, given above, is entirely made up of independent ordinary shares, the number of such shares voted against the resolutions is much in excess of those held by the directors.

The total of 25,216 voted against the resolutions contains my fully paid shares, and shareholders who could not be present trusted to the weight of these being used in their interests. All that Colonel Jackson can urge or has urged against these shares being regarded as identified with the shareholders' interests is that they are fully paid, or, in other words, that I am not subject to calls which the directors cannot under their proceedings long avoid, and that I, personally, do not care for the shareholders' interests, but only to make money for myself at their cost. These statements or insinuations are characteristic of the tactics resorted to by Colonel Jackson in his efforts to effect a compromise so beneficial to his allies, and so disastrous to the shareholders, of which I am one.

The evidence given in my pamphlet of the value of the railway patents, some of which I in part conveyed and some of which I wholly conveyed to the Appliances Company, is incontestible, and it was indorsed, if that was of any importance, by Mr. Smith at the meeting on the 18th ult. I submit that I conveyed property of value to the company in exchange for shares, and unless these shares are made valuable by the proper administration of the company's affairs I shall have given my property and received worthless paper. I submit that I am exactly on the same level and in the same category as those who have given money for their share certificates. But both Colonel Jackson and Mr. W. A. Smith insinuate that I have already received £20,000 in cash and £20,000 in shares from the Williams Company for these same inventions, which shares I hold. This is untrue. And Mr. Smith adds, that having obtained my money from that company I "left it in the lurch" (which is also untrue), thus insinuating that I caused it not to succeed. This insinuation has expanded, possibly under influence or inspiration, so as to appear in a paper as a bold declaration that I endeavoured "to wreck the company," and this paper is the one which has been selected by the directors as the vehicle between them and the shareholders, but the persons responsible for the libel will meet with punishment in the proper quarter.

The £17,500 of shares I received from the Appliances Company represent the shares and interests I possessed in the Williams Company and the further railway patents conveyed by me direct to the Appliances Company, and I transferred to the Williams Company the £17,500 of shares I held in that company.

I submit in contradistinction to Mr. Smith's statement that I

have expended several thousand pounds in prosecuting and pushing the business of the William's Company after its formation, supplied the company, at my own cost, for some years with almost every illustration of the appliances which it possessed, and with nearly every model, and lent the company considerable sums from which I did not derive one penny of advantage, and even since the Railway and Electric Appliances Company acquired these patents I have spent considerable sums in the preparation of plans and documents, and in personal endeavours to carry through the contract with the Wemyss Bay Railway Company. These efforts would have been successful long ago had I not been persistently met and hindered by conduct of the most unsatisfactory character on the part of those managing the affairs of the company.

I have only yet to refer to the private letter to Mr. J. E. Watson which Col. Jackson, without explanation or apology, read at the meeting in order to make it appear that my motives were antagonistic to the shareholders.

As to my object, it must be evident that if I did not hold shares in the company I would not have any interest or right to oppose, but believing, as I do, that the policy of the directors is bad, and that the terms of compromise are not only absurd, but ruinous to the shareholders, I, as a shareholder, preferred to retire from the company in preference to remaining as a shareholder if the assets of the company are to be squandered as under the proposed terms of compromise.

But as I have unwillingly been forced to expend time and money to protect my share-holding, and have received the votes of others in opposing the ruinous policy of the directors, my position to-day is different from that which I occupied when I wrote the referred-to letter, and I am fully convinced that the directors have not the power to compromise the actions of the serious character which they themselves instituted.

J. S. WILLIAMS.

London, *May 8th*.

West India and Panama Telegraph Company, Limited.

THE report of the directors, to be presented at the 14th ordinary general meeting of members, to be held on Wednesday, the 21st May, is as follows:—

The directors submit the accounts for the six months ending 31st December, 1883. The amount to credit of revenue is £45,218 5s. 1d., and the expenses have been £20,617 15s. 2d., leaving a balance of £24,600 9s. 11d., which, with the balance of £3,287 15s. 3d. brought from last account, makes an available total of £27,888 5s. 2d. Of this sum the directors have placed £15,000 to reserve, leaving an available balance of £12,888 5s. 2d., with which it is proposed to deal as follows:—Payment of 6s. per share on account of arrears of dividend on the first preference shares, £10,368 18s. 0d.; balance to current half-year's account, £2,519 7s. 2d.; total, £12,888 5s. 2d.

The traffic receipts show an increase of £4,174 18s. 1d. over those of the corresponding period of last year, and the total receipts are also increased by the chartering of the s.s. *Grappler* to the International Ocean Telegraph Company for the repair of one of their cables connecting this company's system with the United States.

The repair of the original (duplicated) Jamaica-Porto Rico cable, alluded to in the last report, was interrupted by the necessary recall of the company's ship *Grappler* engaged upon it, to repair the Jamaica-Colon and other cables. At the time of her recall 133 knots of new cable had been laid in, the cost of which, £10,316 15s. 3d., has been charged to reserve account. The *Grappler* will resume operations on this section when disengaged.

The directors regret to report that the expectation of further increases to the subsidies encouraged by the liberal action of Trinidad and British Guiana have not been realised. The colonies of the Leeward Islands voted, as has been previously announced, an increase of £1,000 per annum conditionally on proportionate increases by the other colonies. The colony of Barbados alone, of the British colonies represented at the Telegraph Conference of 1882, continues to refuse all favourable consideration of the repeated appeals made by the board, although His Excellency the Governor-in-Chief of the Windward Islands has intimated that, subject to the sanction of the Secretary of State, the colonies of St. Vincent, Grenada and St. Lucia, which are prepared to increase their several subsidies, are at liberty to do so. The Leeward Islands adhere to the conditional application of their resolutions, and thus the expected improvement in the company's position is arrested by the Colony of Barbados.

With reference to the proposal made to the Secretary of State for the Colonies upwards of 12 months ago, the board have received no further communication. Having regard to the length of time that has elapsed, and to the fact that the circumstances have somewhat changed since the proposal was made, the directors have now informed Lord Derby that a reconsideration of the question has become necessary.

The revenue, since the commencement of the current year, has been seriously affected by the unprecedented depression in the sugar markets, and the interruption of the Demerara cable, upon which the s.s. *Duchess of Marlborough* is at present engaged.

Since the foregoing was printed the board have received the full report of the Royal Commission appointed to enquire into the revenues, expenditure, &c., of certain West India Islands, which, whilst admitting the value of the company's system of cables, and that it has now been placed in a satisfactory condition, recommends that in order to reduce the tariff, and secure an alternative route, the system should be connected by an independent cable with North America at Halifax *via* Bermuda, and that until this is done no increase of subsidies be granted.

The commissioners, when making this proposal, were probably unaware that this scheme was propounded at the Barbados Telegraph Conference in 1882, and that it was condemned on physical as well as on financial grounds by the Postmaster-General and the Engineer-in-Chief of the Postal Department, and that Her Majesty's Government finally decided to take no part in any such scheme.

It is manifest that the very large capital outlay, and great expenses necessary to be incurred to carry out such a difficult (if even physically practicable) undertaking, in addition to maintaining the present system which must still be kept up to connect all the colonies together, could not have for their effect the cheapening of telegraphic communication.

As respects duplication the present main line system is already duplicated the whole distance from Trinidad to the American Continent, and the board are convinced that the best means to ultimately cheapen communication is to afford adequate support to the existing system, which it has been shown can be effectually maintained.

Experience has proved that there is not sufficient commercial business for the support of the existing lines without the extraneous aid of subsidies; the additional costly and useless cables as proposed would, therefore, have to be exclusively maintained out of Imperial and Colonial Government funds.

In the opinion of the board the report of the Royal Commission contains the most cogent reasons for an increase of the subsidies for the effectual maintenance of the company's cables as already established, but the directors regret that representing so important an interest as that of the proprietors of the cables connecting the colonies with the telegraph systems of the world, they were not given an opportunity of stating their views to the Royal Commissioners before they reported on the telegraphs of the West Indies.

Submarine Cables Trust.

THE thirteenth ordinary annual meeting of the certificate holders was held at the offices of the Trust, 66, Old Broad Street, on Tuesday. The Marquis of Tweeddale presided. The report was published in our issue of the 3rd inst.

The Secretary, Mr. Lewis Wells, having read the notice convening the meeting,

The Chairman apologised for the absence of Mr. Pender, who, he stated, was one of a deputation waiting upon the Postmaster-General with reference to certain matters connected with telegraphic business. The revenue for the past year had amounted to £23,991, against £22,064 in the previous year; this showed an increase of £1,927, which was attributable to an increase in the dividends on the investments of the Anglo-American and Eastern Extension stocks. In the one case there had been an increase from 2½ to 3½ per cent., and in the other an increase of ¼ per cent. No doubt all were aware of the threatened competition in respect to Atlantic cables, and most probably that competition would influence the receipts of those companies in whose stock this Trust was interested; but it was not for him to express any opinion as to how far that would be the case. It was satisfactory, however, that they could look forward to increased receipts from other quarters, which would enable them to meet their engagements in future. He moved the adoption of the report and accounts.

Mr. John Pender seconded, and the motion was carried.

A holder, remarking on the compactness of the Trust, suggested that means should be taken to insure the registers against any possible danger of fire, &c.

The Chairman said the matter had been considered, but a difficulty arose from the fact that they did not know who were the register-holders. However, if it was the general wish, the matter should again receive their consideration; and if it were feasible at no great cost it should be done.

Mr. John C. Griffiths and Mr. John Gane, the auditors, were re-elected, and the meeting terminated with the usual vote of thanks to the chairman.

London Platino-Brazilian Telegraph Company, Limited.

THE following report of the directors will be presented at the ordinary general meeting of the shareholders on the 22nd inst:—

The net revenue of the year, after providing for debenture interest and income tax, is £6,379 0s. 10d., and £5,233 9s. 11d. is brought from the preceding year's account, making a total of £11,612 10s. 9d. to the credit of the revenue account.

The interim dividend of 2s. per share, paid on 23rd November, 1883, absorbed £3,834 16s., leaving to be dealt with £7,777 14s. 9d., from which the directors propose to appropriate £3,834 16s. in payment of a final dividend of 2s. per share, being at the rate of 2 per cent. per annum, and carrying forward £3,942 18s. 9d., pending the collection of the debt due from the Uruguay Government.

The revenue account shows a falling-off in the company's proportion of the Western and Brazilian Telegraph Company's receipts. This arises from two causes: Firstly, an interruption of

more than two months duration to the cable of the Brazilian Submarine Company connecting Brazil with Europe, which diminished the traffic of the Western and Brazilian Company: and secondly, from a reduction of tariff which took place on the 1st September, 1883, a short time prior to the interruption.

A difference has arisen between the directors of this company and the Western and Brazilian Company, with respect to this company's proportion of the receipts for telegrams sent since the reduction of tariff. Pending adjustment, there has been brought into the accounts only the amount credited to this company by the Western and Brazilian Company.

The 7 per cent. debenture debt of the company became redeemable on the 1st March, 1884, and was replaced by an issue of 1,000 6 per cent. debentures of £100 each. The board is making every effort to obtain from the Uruguayan Government the payment of the accrued debt, and they are hopeful of success. The company's lines are in good working order.

Stock Exchange.—The Stock Exchange Committee have appointed Friday, May 16, a special settling day for 22,253 additional shares of the Hammond Electric Light and Power Supply Company, Limited.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations, May 14.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	8	1⅛ - 1⅜	
		Do. Do.	10	3½ - 4	
20,000	5	Australasian E. L., Power & Storage Co.	3½	..	
24,000	10	British Insulite Co., Ld., "A" Shares..	6	..	
22,000	5	Gt. Western Electric Light & Power Co.	2½	⅜ - ½	
24,380	5	Hammond Elec. Lt. & Power Sply. Co.	5	⅜ - ½	
40,000	5	Indian & Ori. Electl. Storage Wks. Co.	2½	..	
250,000	1	Maxim-Weston Elec. Lt. & Power Co.	1	⅜ - ½	
100,000	5	Metrop. Brush Electric Lt. & Power Co.	5	..	
40,000	5	Pilsen-Joel & Gen. Elec. Lt. Co.	2½	..	
20,000	5	S. African Brush Elec. Lt. & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Ld.	3	¾ - 1	
		TELEGRAPHS.			
1,892,480*l.*	Stk.	Anglo-American, Limited	100	31½ - 32½	
2,553,760*l.*	Stk.	Do. Pref. } Def. receiving no div. until	100	57½ - 58½	
2,553,760*l.*	Stk.	Do. Def. } 6 p. c. paid to Pref.	100	6 - 7	
120,000	10	Brazilian Submarine, Limited	10	10¼ - 10⅝	
16,000	10	Cuba, Limited	10	9⅜ - 10½	
6,000	10	Do. 10 per cent. Preference	10	16½ - 17½	
13,000	10	Direct Spanish, Limited	9	4½ - 5	
6,000	10	Do. 10 per cent. Preference	10	14 - 14½	
65,000	20	Direct United States Cable, Ld., 1877	20	9⅜ - 9½	
100,000*l.*	100	Do. 6 per cent. Deb., repayable 1884	100	98 -102	
380,000	10	Eastern, Limited	10	10⅞ - 11⅛	10⅞
70,000	10	Do. 6 per cent. Preference	10	15 - 15½	
200,000*l.*	100	Do. 5 do. Debs., repayable Aug. 1887	100	102-105	104
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	102-106	
500,000	Stk.	Do. 4 do. Debenture Stock	100	94 - 96	
250,000	10	Eastern Exten., Australasia & China, L.	10	11⅛ - 11⅜	
320,000*l.*	100	Do. 6 p. c. Debs., repayable Feb. 1891	100	108- 111	109½
500,000*l.*	100	Do. 5 p. c. (Aus. Gov. Sub.) Deb. 1900	100	104 - 107	
140,000*l.*	100	Do. do. reg., repayable 1900..	100	104 - 107	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	101 - 103	
550,000*l.*	100 / 100	{ Eastern & South African, Ld., 5 p. c. } { Mort. Deb. Rg. redeemable 1 Jan. 1900 } Do. do. To Bearer	100	103 -106	
20,050	10	German Union Telegraph & Trust, Ld.	10	9⅜ - 10½	
250,000	10	Globe Telegraph & Trust, Ld.	10	6½ - 6⅝	6½
250,000	10	Do. 6 per cent. Preference	10	12⅜ - 12⅝	
150,000	10	Great Northern	10	13⅜ - 13⅝	
100,000*l.*	100	Do. 5 per cent. Debentures	100	102 -105	
300,000*l.*	100	Do. 5 per cent. Debentures	100	102 -105	
81,200	10	India-Rubber, Gutta-Percha, & Tel. Wks.	10	23½ - 24½	
100,000	100	Do. 6 per cent. Debs., 1886	100	100 -103	
18,000	25	Indo-European, Limited	25	31 - 32	
40,000	10	London Platino-Brazilian, Limited	10	3⅛ - 3⅜	
100,000	100	Do. 6 per cent. Debentures	100	99 -101	
12,000	10	Mediterranean Extension, Limited	10	1¼ - 1⅜	
5,200	10	Do. 8 per cent. Preference	10	2 - 4	
10,000	8	Reuter's, Limited	8	8 - 8½	
338,225*l.*	Stk.	Submarine	100	159 -160	153
75,000	1	Do. Scrip	1	1⅛ - 1⅜	
4,200	Cert.	Submarine Cables Trust	100	97 -100	
37,330	12	Telegraph Construction and Mainten.	12	33 - 34	
150,000	100	Do. 6 per cent. Bonds, 1884	100	107 -109	
186,750	5	Do. 2nd Bonus Trust Cert.	2½	1⅛ - 1⅜	
20,000	10	West Coast of America, Limited	10	6¼ - 6⅝	
120,000*l.*	100	Do. 8 per cent. Debs.	100	108 -110	
45,791	15	Western and Brazilian, Limited	15	5⅜ - 5⅝	
24,119	7½	Do. Preferred	7½	4⅜ - 4⅝	
24,119	7½	Do. Deferred	7½	1⅜ - 1⅝	
200,000*l.*	100	Do. 6 p. c.. Debs. "A" 1910	100	102 -105	
280,000*l.*	100	Do. 6 p. c. Mort. Deb. B. '80, red. Feb. 1910	100	98 -101	
1,500	$1,000	Western Union 7 p. c. 1 Mort. (Bg.) Bds.	$1,000	121 -123	
1,000,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -106	
58,321	10	West India and Panama, Limited	10	⅜ - 1½	½
24,563	10	Do. 6 per cent. 1st Preference	10	7 - 7½	
4,669	10	Do. 6 do. 2nd do.	10	4⅛ - 5⅛	
		TELEPHONES.			
224,880	1	Con. Tele. & Mainten., L., Nos. to 154,165	1	1/16 - 1/8	
225,000	1	Oriental Tele. Co., Nos. 80,001 to 300,000	1	⅛ - ¼	
100,000	5	United Telephone Co.	5	7½ - 8	
20,000	5	Do. New, issued 2 pm.	2	..	

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending May 9th, 1884, were £2,916, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

PROCEEDINGS OF SOCIETIES.

The Society of Telegraph-Engineers and Electricians.

AN ordinary general meeting of this society was held on Thursday, May 8th, Professor W. G. ADAMS, F.R.S., President, in the chair. The minutes of the last ordinary general meeting having been read and confirmed, and the list of new and proposed new members announced, a paper by Mr. H. MANCE, on "A method of localising faults in submarine cables," with notes by Mr. Latimer Clark, was read by Mr. L. CLARK.

A very large number of formulæ for localising faults at present exist in text books, and it would hardly seem necessary to add to these. The object of Mr. Mance's paper was, however, merely to supplement these formulæ. To render testing of value, it is very essential that it should be accurate. To enable this accuracy to be attained, the effects of polarisation and of earth currents require to be eliminated. Several formulæ exist for this purpose, but they all suppose that the currents are constant, which is seldom the case. To make a test on shore is one thing, to make a test on board ship is another; in the latter case, rapidity is a great essential, and prompt decision is necessary. One difficulty in making an accurate test is due to the resistance of the fault itself. This resistance is most marked when short lengths of cable are tested, and therefore in such cases a correction is very necessary. To enable tests to be made with facility, a small slide resistance adjustable to units, in addition to the ordinary plug resistances, is very useful, and such a slide is employed by Mr. Mance in the apparatus * designed by him for the localisation of faults. The general principle of the new method of localising faults is first to obtain a balance with the 100 proportional coils, and then to alter the latter to 1,000 each, and again to obtain balance. The resistance, x, of the cable up to the fault (including the resistance of the latter) is then given by the formula

$$x = \frac{R_1 (2r + P_2) - R_1 (2r + P_1)}{R_2 + P_2 - P_1 - R_1}$$

where r is the resistance of the battery; P_1 the resistance of each of the proportional coils at first; P_2 the resistance of each of the proportional coils in the second case; R_1 the balancing resistance at first; and R_2 the balancing resistance in the second case. Although it is not absolutely necessary to employ equal ratios in the proportional coils, yet Mr. Mance prefers to do so, otherwise the formulæ become very much more complicated. To make the test satisfactorily, it is essential that the battery be in good condition. It is also advisable to bring the fault to the middle by adding resistance to the end of the cable to which the fault is nearest. The formula and test in question provides for the elimination of earth and polarisation currents, but not for the resistance of the fault itself. This latter point is an interesting question. The author has made attempts to measure the resistance of faults by his method of measuring the resistance of a battery, but without any satisfactory results. Experiments made seemed to prove that the resistance of a fault caused by about ⅛ an inch of bare copper being exposed, ranged from 7 to 12 ohms; that is in measurements made on the Persian Gulf cable. The first test made for localising a fault is usually the most reliable. Even when the copper conductor touches the iron sheathing, the resistance of the fault does not become reduced to zero. The amount of battery power used varied the resistance of the fault. Thus, a 30-cell test gave the position of a fault by the ordinary formula as 471 ohms, and by the corrected formula as 484 ohms; with a 5-cell test the resistances were 391 and 471 respectively. When resistance was inserted at one end of the cable so as to bring the fault to the middle as nearly as possible, the readings with 30 cells were 476 and 489 respectively. The resistance of the fault averaged about 10 or 12 ohms. It is obvious that the method of testing could be applied for determining the conductor resistance of a perfect cable or land line. Mr. Mance stated that he had employed his new method for four years, but had hitherto withheld it from publication. He would point out that one great point of value in it lay in the fact that reversed currents were not used, and one test could in consequence be made immediately after the other. Mr. Clark then pointed out that as early as 1861 Mr. Laws and himself had made experiments to determine the resistance of faults; and in 1862 the results were published in the *Electrician*. The resistance of faults appeared to decrease with the battery power employed. In 1862, he had patented a method of eliminating the earth current when testing, by joining in the circuit of the line a small shunted battery. The "false zero" method of testing practically gave the same result. He would point out that the study of artificial faults under the microscope was an extremely interesting one.

In the discussion which followed the reading of the paper,

Mr. W. H. PREECE said that in the early days of telegraphy the workers were greatly handicapped by the non-existence of any society before which they could ventilate their views. He thought that Mr. Mance had really brought forth nothing new as regards the properties of faults, as the subject had been well worked out many years ago. Skill and experience in testing was everything. Mr. F. C. Webb, with a comparatively rough apparatus, had obtained results similar to those of Mr. Mance. He would conclude by saying that the men of the present time had much to be thankful for in the fact of the existence of the society.

* This apparatus is manufactured by Messrs. Clark, Muirhead & Co.

Professor AYRTON thought that Mr. Preece had not done justice to Mr. Mance's paper, as he had not distinguished between Mr. Mance's and Mr. Clark's remarks. The method of testing by employing two different proportional resistances was far better than the reversal method. He thought that the method might be improved upon by altering *one* of the proportional resistances instead of both, so that the current through the cable would remain approximately constant. The dimension of a fault could be determined by the *rate* at which polarisation took place.

Mr. KENELLEY said that if the resistance of the testing battery were very small, the formula would be considerably simplified. He thought it would have been better if Mr. Mance had expressed his formula in terms of the differences of current passing through the fault. With reference to Mr. Mance's remark that the resistance of a fault when the conductor touched the iron sheathing was not zero, he would state that with a copper-sheathed cable he had found the resistance to be practically nothing.

After a few remarks by Mr. CLARK in reply, the meeting adjourned.

NEW PATENTS—1884.

7375. "Facilitating the use of electric currents for telegraphic purposes." R. K. BOYLE. Dated May 7.

7380. "Electric telephones." C. LEVER. Dated May 7.

7383. "Insulators for telegraphic poles." A. F. LINK. (Communicated by H. Müller.) Dated May 7.

7436. "Regulating supply of gas in railway trains by electricity." W. E. LANGDON. Dated May 8.

7439. "Portable apparatus for electric lighting purposes." A. M. CLARK. (Communicated by G. Trouvé.) Dated May 8.

7440. "Regulating feed of single or double, or of any combination of the sets of carbons used in electric arc lamps." W. R. OSWALD, W. R. FOSTER. Dated May 8.

7444. "Electrical apparatus for lighting gas or other lamps, or the like." J. H. JOHNSON. (Communicated by W. Deckert and E. Homolka.) Dated May 8.

7475. "Electric arc lamps, the same being also applicable to incandescent lamps with combustion in air." R. H. COURTENAY. Dated May 9.

7500. "Producing power to induce electricity." W. K. HILLYARD, G. NEWNES. Dated May 9.

7512. "Establishing and maintaining electrical communication between fixed and movable parts of electric circuits; chiefly designed for use on railways." W. R. LAKE. (Communicated by N. de Kabath.) Dated January 10.

7515. "Counters or apparatus for recording the passage of electricity in lamp circuits, and for other uses." S. PITT. (Communicated by J. Cauderay.) Dated May 9.

7533. "Dynamo-electric machines." G. HOOKHAM. Dated May 10.

7534. "Incandescent electric lamps and glasses therefor." G. HOOKHAM. Dated May 10.

7548. "Anchoring telegraph poles." R. H. TWIGG, J. C. JOHNSON. Dated May 10.

7590. "Removable metallic tubes for underground telegraph and telephone conductors." H. J. ALLISON. (Communicated by E. Perrody.) Dated May 12.

7624. "Electro magnetic motors, and the method of applying the current without reversals or changes of polarity." E. TOYNBEE, I. R. CULLEY. Dated May 13.

7668. "Electric meter." J. S. RAWORTH. Dated May 13.

7669. "Galvanic batteries." B. J. B. MILLS. (Communicated by B. H. Cadot and C. J. M. Barbier.) Dated May 13.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

4381. "Electric lamps." J. W. SWAN. Dated September 13. 2d. Consists in subjecting the platinum wire to be used in the construction of incandescent lamps to a treatment which will effect the removal from it of the occluded atmospheric air, and the substitution of a gas chemically inert as regards the carbon filament. (*Provisional only.*)

4393. "Telephonic apparatus." T. H. MEATCHEM. Dated September 13. 8d. Relates to combined and compound or multiplying transmitters, and combined compound or multiplying receivers and devices connected therewith, used in a telephone, the object being to augment the utility of the telephone, to increase its power of transmitting and receiving messages, and generally to increase the clearness and distinctness of the sounds rendered, and the adaptability under varying conditions of the apparatus.

4427. "Igniting and discharging cartridges, &c., by electricity." T. P. WOOD. Dated September 15. 2d. The electric power is obtained from a battery or batteries with or without intensity coils, or from electric accumulators enclosed in the butt end, or any other part of the gun or rifle or other fire-arm stocks, and providing also for the utilisation of the whole or part of the aforesaid stocks for receiving an electric battery or batteries, or for storing electricity for the above-mentioned purposes and said electric discharge explodes an improved cartridge, and provides for the discharge of the electric current by specially designed safety triggers. The improved cartridges for the aforesaid guns, rifles, and such other fire-arms, are made of paper vulcanite, or any other non-conducting material, and in the base of said cartridges are inserted the wires necessary for the ignition as before described, and there is also provided a safety cover or protector to the incandescent wire or other wire or substance affixed for ignition purposes. The safety triggers consist of movable insulated wires affixed to upper edge of triggers, and provide for their falling back into safety from battery circuit by an arched trigger spring, playing in notches cut in the triggers, and this arrangement provides also for a detached leverage being used. (*Void by reason of the patentee having neglected to file a Specification in pursuance of the conditions of the Letters Patent.*)

4440. "Electrical signalling and indicating apparatus." G. PORTER. Dated September 17. 2d. Relates to improvements in electrical signalling apparatus of that class usually employed to indicate from which part of a building or otherwise a bell is rung, the object of the invention being mainly to provide means whereby the whole of the electric current may be employed firstly for operating the indicator and then the bell, or *vice versâ*, thereby requiring less battery power than hitherto; the improvements have also for object to simplify the construction of such apparatus, and thereby reduce the cost of production. (*Provisional only.*)

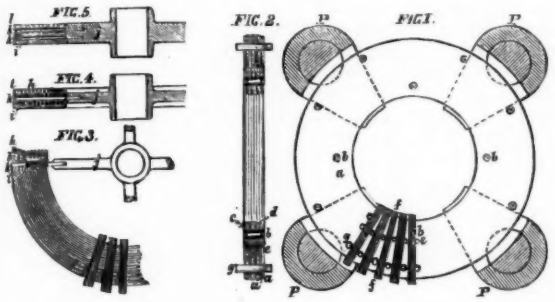
4460. "Electric cables and apparatus or devices connected therewith." A. J. BOULT. (Communication from J. B. Hyde, of America.) Dated September 18. 8d. Relates to improvements in underground and under water electric conductors, which consists of insulated and enveloped wires covered with an armour of lead, and the improvement first consists in the peculiar structure of such cable that enables the inventor to form two or more distinct cables simultaneously from the same press and die, the peculiar structure of the cable affording him the largest number of wires for the like proportion of lead with equal ductibility of cable; and it consists in an economical form of the cable in the cross section; and in condensing the lead armour by pressure rollers to ensure homogeneity of the lead, and to prevent leakage, and also in covering or coating the lead with non-conducting adhesive media as a protection to preserve it from decomposition and loss of conducting power. It further consists in the equilateral configuration of the cable approaching a triangle with two of the edges rounded, whereby an insulated wire is carried in each angle and one in the centre.

4465. "Fittings for electric lighting, &c." J. H. SHELDRAKE. Dated September 18. 6d. Consists chiefly in a novel construction of contact maker and breaker. The invention also consists in a novel arrangement of means for carrying the contact maker, and for securing the same to the walls of apartments.

4467. "Solutions used in galvanic batteries." W. R. LAKE. (Communicated from abroad by F. H. Peckham, junior, of America.) Dated September 18. 4d. Consists in employing glycerine, in combination with other ingredients or chemicals, to form battery solutions. The advantages resulting from the employment of glycerine in battery solutions are as follows, that is to say: in gravity batteries the deposit of crystals on the jars and on the connections is almost wholly avoided. The blue vitriol solution is prevented from rising and depositing copper on the zincs. The zincs are more easily cleansed, and the specific gravity of the solution is more constant. In the Leclanché, and similar batteries, the deposit of crystals on the porous cups and around the metal fastenings of the carbons is prevented, and the rapid deterioration of the battery, caused by such deposits, is thereby avoided. In batteries charged with a solution containing glycerine, as above described, evaporation is reduced to a minimum; and attention to the battery is required only at comparatively long intervals. The electromotive force of the battery is not diminished when it is exposed to extreme cold, to so great an extent as in batteries charged with the usual solutions; and the glycerine solution will not freeze except at a very low temperature.

4419. "Improvements in dynamo-electric machines." W. M. MORDEY. Dated September 15. 6d. In an improved dynamo-electric machine, according to the invention, the inventor builds up the core of the armature, which according to the invention is of the ring disc type of a number of plates separated from one another by non-conducting material, he not only separates the parts forming the core of the armature magnetically but also electrically, and to this end he insulates all the bolts or rivets by which the said parts are connected together, or he forms them of non-conducting material, and thus he obviates, to a great extent, the generation of Foucault or eddy currents. Fig. 1 is an elevation of the partly wound core of the armature showing four poles; fig. 2 is a section of the same; fig. 3 is an elevation partly in section of the ring or hoop armature with hub; fig. 4 is a section showing detail view of armature core, and the attachment to the hub; fig. 5 is a section showing a ring having two sets of hoops. A number of thin iron discs or plates, *a*, *a*, figs. 1 and 2, are placed side by side and connected by means of brass or other non-magnetic bolts or rivets, *b*, *b*, passing through tubes or bushes, *c*, *c*, of wood

or other suitable insulating non-magnetic material. The bushes and bolts pass through washers, *d*, *d*, of an insulating substance (mica being a suitable material) for the purpose of slightly separating the plates from each other, thus leaving air spaces between the plates. To facilitate air circulation through these spaces the inventor sometimes drills holes, *e*, *e*, through the ring disc at intervals, leaving these holes open to the external air. The use of metalic bolts or rivets, *b*, *b*, which are used only for strength, may be dispensed with where the size of the armature is such that sufficient strength can be obtained without them, and screwed bolts of *lignum vitæ*, or other dense unyielding non-conducting material, may be substituted. The armature core is wound with numerous coils of wire in such a manner that the convolutions of each coil, *f*, *f* (fig. 1), are nearly or quite parallel to each other, but the centre convolution of each of the coils is radial, the coils being close together at the inner periphery of the ring, but slightly separated towards the outer periphery. For the purpose of supporting the coils, and for convenience of winding, the inventor fixes pegs, *g*, *g*, of wood, or other suitable insulating material, through the ring disc near its outer circumference, so that they project from the side of the ring disc, and are flush with the outer surface of the coils. It will be seen on reference to figs. 1 and 2 that the iron is laminated, and the plates are electrically insulated in planes at right angles to the axis of the ring. As, however, the field-magnet pole pieces, P, P, as shown in the drawings, are constructed to act directly on the sides of the armature as well as on its periphery, it will be observed that to most effectually check the generation of Foucault or eddy currents in



the core of the armature when the machine is of the construction here illustrated, the lamination of the iron should be principally parallel to the axis of the armature; that is to say, the division of the iron should be chiefly perpendicular to the wire passing over the side of the ring disc. For these reasons the inventor sometimes constructs the armature as shown in figs. 3, 4 and 5. A number of thin rings or hoops of soft iron, *h*, *h*, whose width is the thickness of the ring disc (except near the periphery, where the rings are made a little narrower) are constructed of graduated diameters. These are built up into a ring disc by arranging them concentrically one within the other with a small space separating each ring or hoop from the adjacent ones. The separation is effected by suitable insulating material, such as mica. This insulating material may be in the form of rings, or it may be merely in the form of slips placed at intervals, thus leaving air spaces between the rings or hoops to facilitate cooling. A method the inventor finds convenient is shown in figs. 3, 4 and 5, where the washers, *i*, *i*, surrounding the bolts, *k*, *k*, are the separating pieces. The ring disc so constructed is mounted in the following manner. A hub, *j*, of brass, gun-metal, or other suitable metal or alloy, is fixed into the ring disc by bolts, *k*, *k*, passing through holes drilled radially through the group of rings or hoops, and screwed into the arms of the hub, the outer ends of the bolts being made flush, or nearly so, with the periphery of the ring disc. To prevent the bolts from electrically connecting the various hoops of the ring disc the holes through which they pass are fitted with bushes or tubes, *l*, *l*, of a dense unyielding non-conducting material, *lignum vitæ* being a suitable substance. The inventor also fits the ring disc with projecting pegs, *g*, *g*, for the purpose of separating and supporting the coils near the periphery, and for convenience of winding as in the armature shown in figs. 1 and 2. Sometimes he makes the armature of two or more sets of hoops built up as above and placed side by side as shown in fig. 5, with a slight air space or sheet of suitable insulating material, such as asbestos paper between them.

4473. "Insulated conductors, &c., for telephonic purposes." A. R. BENNETT. Dated September 19. 4d. The first part of the invention consists of the use of wire composed of iron or steel, preferably of a soft and ductile quality, in lieu of copper in all such covered conductors and cables for telephonic purposes as are set forth above, which iron or steel may be bare, or coated superficially with zinc, tin, lead, copper or nickel, or with black oxide of iron. Or it may be painted, varnished, or oiled before being covered with gutta percha, India rubber, paraffined cotton, bitumen, ozokerit, or other insulating material. The second part of the invention is designed to provide a cheap system of underground telephonic communication for use chiefly in towns and cities, which shall be free from inductive disturbances between wire and wire; and to provide means of inter-communication between any telephonic system on the metallic circuit plan, and any telephonic system composed of single wires joined to earth at their extremities. (*Provisional only.*)

4501. "Propelling cars, &c., by means of electricity," P. R. ALLEN. Dated September 20. 4d. Relates to improvements in the propulsion of cars and other vehicles on rails or tramways, or other places, and refers principally to those instances in which electro-motors are used for propelling the vehicles, but certain of the improvements may be used in other cases. (*Provisional only.*)

4531. "Construction of electric accumulators and secondary batteries." A. C. HENDERSON. (Communicated from abroad by G. Philippart, of France.) Dated September 22. 6d. The batteries are formed of conical vessels of lead, cast in moulds, on the external surface or positive electrodes of which the active matter, such as salts or oxides of lead, is applied. On these conical or other shaped vessels small projections in the form of grooves, flutes, channels, and so on, are made to keep the active matters on the surface of the electrodes. The negative electrode, or inner surface of these vessels, is cast with deep and close symmetrical projections, which largely augment the surface directly attacked by the action of the current, and thus effect a rapid transformation of the lead projections into peroxide of lead. The cones are piled one within the other, the lower one being supported in a base, care being taken to separate them with insulating matter, the spaces being filled with acidulated liquid, or caustic solution.

CORRESPONDENCE.

Technical Colleges.

A few days ago I noticed in one of the leading daily papers that the professors had been appointed to the new college erected at South Kensington by the Council of the City and Guilds of London. Among the names I noticed that of the present professor of chemistry at the Institute, Tabernacle Row. Having been a student at the Institute for nearly three terms (and I hope to be able to continue for three years), although not attending the professor's own lectures on organic chemistry, I have several times had occasion to meet him in the laboratory, and I think I am justified in saying that the students will be sorry to lose him. At the same time, I hope that the new college will not mean the migration of our demonstrators for chemistry and electricity, together with our lecturers on geometry and elementary mathematics and mechanics. I am certain that I am right in saying that they are all exceedingly popular and extremely hardworking. Our professors of electrical and mechanical engineering are too well known to need my saying anything in reference to them. But I think that it is all important that while appointing first-class professors and demonstrators to the Central Institute, that the Council should not in any way lower the efficiency of the staff at the present college, to which I am certain that one or two more assistants (especially in the electrical department) might be added with a good result both to demonstrators and students. I am also surprised that no lending library or library of reference of scientific works has been established; it is in my opinion greatly needed, although, of course, the institute being comparatively new, there is plenty of time for improvement.

Taking everything into consideration, the college is admirably conducted considering the large number of students, and a student may, with a little industry, learn there a very large amount of useful knowledge.

Science.

1, Glengall Road, Old Kent Road, S.E.,
May 10*th*, 1884.

P.S.—At the same time in sending the enclosed letter, I should like to ask you if you do not consider that the present dot and dash of the Morse system of electric telegraphy might not have been much more modified in the number of dots and dashes used. I have taken the liberty of enclosing a shorter system.

[Our correspondent's "modification" appears to consist in a variable length of "dash." This, as arranged, would lead to no end of confusion in practice.—EDS. ELEC. REV.]

Tests of Dynamo-Electric Machines.

Will you be kind enough to publish in the ELECTRICAL REVIEW the enclosed report of tests of one of my "unipolar" dynamos taken April 25th and 26th.

Charles E. Ball.

London, *May 7th*, 1884.

April 29th, 1884.

CHAS. E. BALL, Esq.,

Dear Sir,—In compliance with a request from Mr. Robert Sabine, we visited the Silvertown Works of the India Rubber, Gutta Percha, and Telegraph Works Company on Friday and Saturday last, for the purpose of testing one of your dynamo-electric machines, constructed nominally for supplying 10 arc lamps. It is, however, capable of actuating a larger number.

The potential difference of the machine between terminals was measured by the condenser method, a Clark's standard cell being employed for comparison of electromotive forces. Two Siemens' electro-dynamometers, one of these being supplied by us, indicated the current strength, each instrument giving identically the same readings. The external resistance, and that of the machine, were measured immediately after each test. Horse-power measurements were taken by means of a Morin transmission dynamometer and a Prony brake.

Countershafting was placed between the dynamometer and the dynamo, the former being so arranged as to run at about the same number of revolutions per minute for vaying speeds of the dynamo, this being accomplished by using pulleys of different diameter on the latter. The Prony brake, which was balanced, gave admirable readings, there being but a difference of two ounces in the weight applied at the end of the lever in three distinct measurements.

The principal test was made as nearly as possible under the same conditions of speed and current as that taken previously by the Silvertown electricians. The results obtained by us are tabulated as follows:

TABLE OF TESTS.

DOUBLE ARMATURE BALL "UNIPOLAR" MACHINE.

Date, April 29th, 1884.

No. of Test.	Current in Amperes.	Resistances in Ohms.			Electrical Work.				Mechanical Work. Prony Brake.			Revolutions of Dynamometer.	Morin Dynamometer.			Percentage of Efficiencies.				Revolutions of machine. Average.
		External R − r.	Dynamo r	Total R	Watts C^2 R	H.P. External.	H.P. Internal.	H.P. Total.	Weight in lbs.	Length of lever. feet.	H.P. absorbed.		Pull machine loaded. Kilog.	Pull machine empty. Kilog.	B.P. Calculated.	Conversion.	Appearing in External Circuit.	Commercial, calculated from absorbed H.P.	Commercial	
*A	8·07	56·0	17·15	73·15	4764	4·888	1·497	6·385	...	...	...	378	69	14	6·83	93·5	76·5	71·5	63·3	1290
*B	8·07	68·8	16·93	85·73	5583	6·00	1·479	7·479	...	...	...	365	89	20	8·28	90·3	80·3	72·4		1620
†A‡	8·07	59·33	17·12	76·45	4980	5·179	1·494	6·674	13·94	2	6·9	384	75	18	7·16	93·2	77·6	72·3	67·3	1300
														Prony brake		96·7	„	75·0	70·0	...

* April 25. † April 26.

OBSERVATIONS.—Test A ‡ is nearly a reproduction of test A, and to it was applied the Prony brake; in three separate measurements at varying intervals the weights applied at the end of the lever were 13 lbs. 15 oz., 13 lbs. 14 oz., and 14 lbs. respectively. The formula is $\frac{n \times L \times x}{5252}$ where n is the number of revolutions per minute, L the length of lever, and x the weight. The formula for the Morin transmission dynamometer is $\frac{1{\cdot}5 \times K \times s}{60 \times 76{\cdot}04}$ where s is the speed and K the indicated pull in kilos on the dynamometer less the pull when the circuit is open. When the Prony brake was employed to measure the absorbed horse-power the Morin instrument was used as an indicator. Thus, when electrical work was being produced with the machine running at 1,300 revolutions the Morin indicated 75 K, this pull was then reproduced in the Prony brake test with the machine running at the same speed. The commercial efficiency of the machine is calculated both from the absorbed horse-power alone and with the addition of the horse-power which the machine requires to run at 1300 revolutions unloaded = 0·54 H.P. Test B, at a higher speed, was taken at the suggestion of Mr. Ball. In test A ‡ the Prony brake was resting by its own weight upon one of the pulleys of the dynamo when doing electrical work, and also when running empty. The external circuit was, in each case, made up of a wire resistance.

It will be seen that the data obtained by us agree very nearly with the figures taken by Mr. Robert Sabine on one of your machines as long ago as March of 1883, an improvement, however, being observable in the later form of machine. It would appear to be more economical to run the dynamo at the higher speed from an electrical point of view, for, although the percentage of conversion is somewhat lower, a larger percentage of energy is accounted for in the external circuit. From what we can gather regarding its mechanical construction it appears to be a remarkably cheap dynamo to build up, and, at the same time, its constituent parts are very unlikely to get out of order. The double commutator may be considered, from the constructor's point of view, as a disadvantage, but electrically it is decidedly advantageous. By spreading a given amount of wire over two armatures, as in your machine, double the cooling surface is provided, and the pole pieces of the field-magnets are thereby brought much nearer to the armature core.

We may mention here that after Mr. Sabine had reported on your machine of 1883, we assisted him in a series of exhaustive tests on the same dynamo, and, with this experience, we have now no hesitation in expressing a high opinion of the Ball machine.

We are, dear Sir,
Faithfully yours,
H. ALABASTER, GATEHOUSE & Co.

The Size of Conductors: An Explanation.

I observed that, in a report in the ELECTRICAL REVIEW for April 5, of a paper by Prof. G. Forbes on the size of conductors, an estimate of the current which might be safely carried by a conductor was attributed to me, and I have since seen a proof of the complete paper in which it is further stated that I am the author of a paper containing that estimate in the *Philosophical Magazine* for September last. Please allow me to say that I have written nothing whatever on this subject, and that the paper to which Prof. Forbes seems to refer is by my brother, Mr. T. Gray. Without going into the matter further, I should like, as my brother is at present abroad, to say also, that Mr. Forbes's remark that "Mr. Gray has also taken notice of the failure of Sir W. Thomson's law for high currents" is incorrect, and must have originated in some misunderstanding.

Andrew Gray.

Glasgow, *May 7th*, 1884.

The Gordon Dynamo-Electric Machine.

Having been informed that the Gordon dynamo-electric machine is capable of feeding a greater number of lamps in a circuit than any other machine at present constructed, I should esteem it a favour if you, or some of your correspondents, could inform me, through your columns, if such is the case, and if not, if you, or they, could give me the name of a machine which is superior to such Gordon machine.

Enquirer.

150, Haverstock Hill, N.W.,
May 13th, 1884.

[Mr. Gordon's dynamos have been constructed of such a size as to produce a current for supplying a far greater number of lamps than any other single machine, in this country at all events.—EDS. ELEC. REV.]